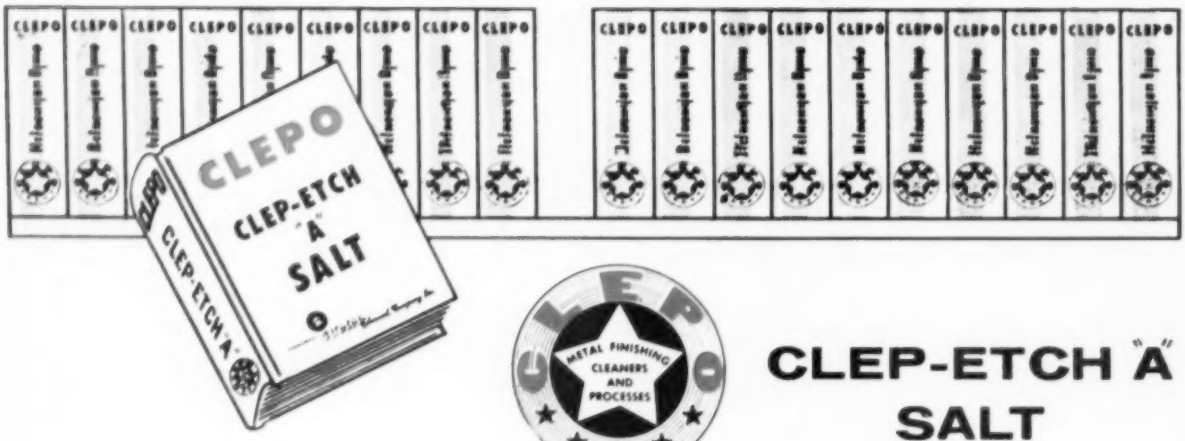
plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

APRIL

University Microfilms
313 N. First St.
Ann Arbor, Michigan

LIBRARY OF CLEPO SERVICE



CLEPO — METAL FINISHING CLEANERS AND PROCESSES

CLEP-ETCH "A" SALT

3 VALUES

FOR THE PLANT WORKING WITH ALUMINUM

- Excellent for whitening Silicon Aluminum castings before burnishing
- Excellent for removing smut from etched Silicon Aluminum Castings
- Excellent for stripping anodized castings

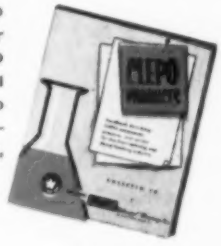
CLEP-ETCH "A" is a dry granular salt which enables the operator to eliminate hydrofluoric acid treatment from his processing. And the solution made by dissolving CLEP-ETCH "A" with nitric acid is exceptionally stable. It does not deteriorate in standing. It will not attack the aluminum base metal during normal immersion cycles.

CLEP-ETCH "A" SALT is available in 50 lb. and 325 lb. drums. Write for generous free sample for laboratory tests on your article CLEP-ETCH "A" will show up well, we are sure. Then order enough—say a 50 pound drum—to make a comparison run with compounds you are now using. You be the judge of its merits. In writing for a trial sample, please outline your operations so that we can send you proper instructions.

OUR NEW GENERAL CATALOG No. 10

Just Released

It tells about the scores of CLEPO Compounds and outlines their many uses, it tells about CLEPO Service and lists the skilled field service man in your territory who will be glad to help with *any* problem involving cleaning, stripping, etching, pickling, etc.



FREDERICK GUMM *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N. J.

4-FG9

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE B 400.

for superior product appeal . . .

EBONOL OXIDE FINISHES

For STEEL, COPPER, BRASS and ZINC

- maximum wear resistance
- high adhesion
- jet blackness

With extensive laboratory facilities, a staff of trained technicians in the plant and in the field, and years of practical experience, Enthone Incorporated is exceptionally well equipped and qualified to study your metal blackening requirements (or any other difficult metal finishing problems) and recommend a practical solution. Write now, outlining your needs.

ENTHONE INCORPORATED

442 ELM STREET, NEW HAVEN 11, CONNECTICUT

Metal Finishing Processes • Electroplating Chemicals

Service Representatives and Stock Points in Principal Cities of U.S.A. and Canada, Brazil, England, France, Sweden, and Germany

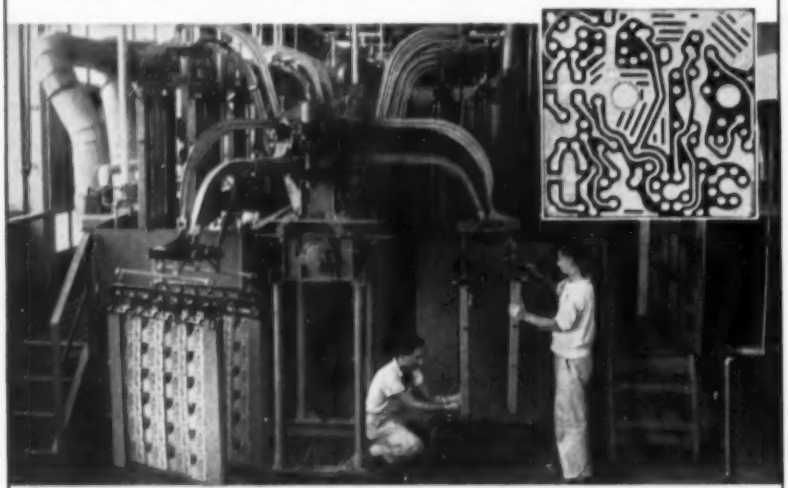
THE FINISHING TOUCH

A. B. HOEFER, *Vice-President*, FREDERIC B. STEVENS, INC.

STEVENS MACHINE SPEEDS PRODUCTION OF PLATED CIRCUITS

POSSIBLY ONE OF THE BIGGEST TECHNOLOGICAL ADVANCES in methods and materials for the assembly of electronic equipment is proving to be electrically conductive lines of copper, plated to uniform thicknesses on a plastic circuit board. Stevens is proud to be playing a part in this advancement.

ONE LARGE MANUFACTURER IS OBTAINING 2,880 PLATED CIRCUITS an hour with a Stevens Automatic Rack Type Processing and Plating Machine. The machine carries two



Stevens Automatic Processing and Plating Machine used for copper plating circuits at General Electric Company, Auburn, New York.

racks per arm, with each rack holding twenty-four circuits in position for plating. The results, beside the high production, are uniformity and "sure-fire" conductivity.

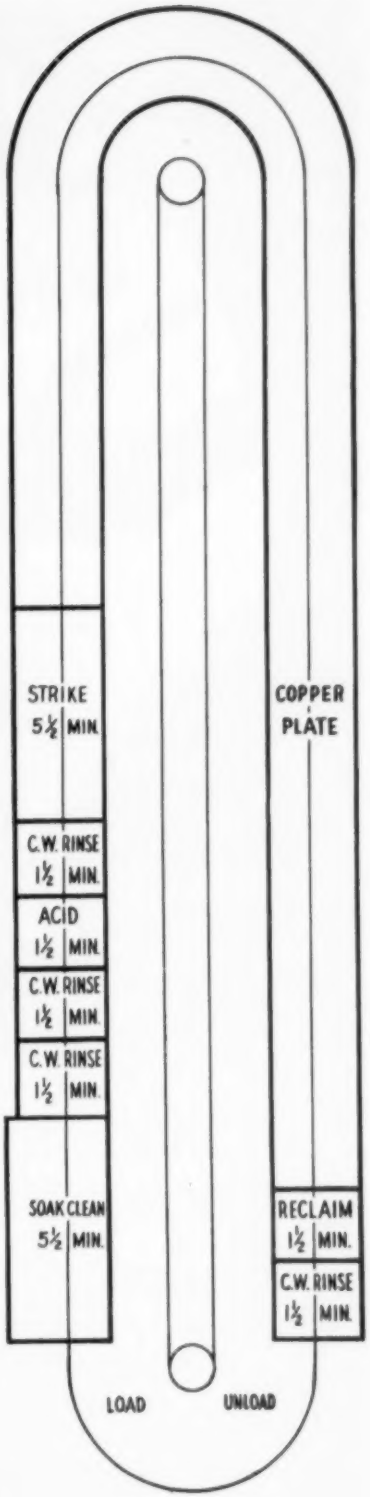
ANOTHER ADVANTAGE OF THE PLATED CIRCUITS is the "plated through" holes or eyelets which form a mechanical bond to the circuits on both sides of the base and also eliminate connective wiring of the two circuits.

Our engineers are constantly working toward the development of new ideas in plating and metal finishing. Why not let us help you in such problems as plating, anodizing, pickling, cleaning, electro-cleaning, phosphating, stripping, lubriting and other types of immersion processing. Write Frederic B. Stevens, Inc., 1804 Eighteenth Street, Detroit 16, Michigan.

FREDERIC B. STEVENS INCORPORATED
YOUR METAL FINISHING SUPERMARKET
DETROIT 16, MICHIGAN

STEVENS 75 YEARS OF SERVICE

WAREHOUSES AND OFFICES IN PRINCIPAL CITIES



Suggested cycle for automatic plating or forming of plated circuits.

An Educational Society for the Advancement of the Science of Electroplating, the Finishing of Metals and Allied Arts

John P. Nichols
Chairman, Editorial Board and Managing Editor

Rodney Leeds
Editor

Ann Panico Freda
Editorial Assistant

Dr. Abner Brenner **Arthur W. Logozzo**
John B. Capuano **Howard J. McAleer**
Phillip M. Coady **Robert D. Miller**
S. Lewis Doughty **Fremont L. Scott**
Dr. Russel E. Harr **William M. Tucker**
Dr. Harold J. Wiesner
Editorial Board

Francis R. Murphy
Production Manager

H. A. Johnston
Acting Advertising Manager

Lee F. O'Connell
111 N. LaCienega Blvd., Beverly Hills, Calif., OLympia 2-1313

William Ayres
Lee F. O'Connell Co.
233 Sansome St., San Francisco 4, Calif. YUkon 6-2981
Western Advertising Representatives

SOCIETY of BUSINESS MAGAZINE EDITORS

COVER—An artist's conception of the important relationship of Plating and the American Electroplaters' Society. **Designed by James A. Civille.**

plating

Journal of the American Electroplaters' Society

April 1957 **Vol. 44, No. 4**

Editorial:

The Answer Lies With You 351

The Photometric Determination of Molybdenum in Zinc Cyanide Plating Solutions 380
by J. P. Leftin

The Determination of Copper in Nickel Solutions 383
by Thomas A. Downey

Alignment Chart for Finding Weight and Area of Springs 386
by George C. Field

Plating on Aluminum Bronze 387
by I. William Marcovitch

Microthrowing Power—A Literature Search 388
by Esther B. Leffler and Henry Leidheiser Jr.

AES 44th Annual Convention, Tentative Schedule of Events 408

AES Branch Directory	444	Future Meetings	444
AES Directory	444	Industry News	358
AES Membership Report	425	Industry News Briefs	360
AES News	420	Index to Advertisers	445
Article References	412	Intersociety News	416
Books	378	Mailbox	400
Branch News	427	Patent Abstracts	402
Classified Advertisements	442	Personals	370
Equipment and Supplies	364	Trade Literature	372

Published by the American Electroplaters' Society, Incorporated, 445 Broad Street, Newark 2, N. J. Phone: HUmboldt 2-3400. Yearly subscription for Members $2.00. Nonmembers U. S. and Canada $5.00, 65c a copy. Foreign, $8.00 a year, $1.00 a copy.

Copyright, 1957, by the American Electroplaters' Society, Incorporated.

PLATING is abstracted regularly in Chemical Abstracts, Metals Review, Metallurgical Abstracts, Engineering Index, Technical Data Digest, and Bulletin Analytique.

Statements of fact and of opinion given in articles and papers in PLATING are those of the contributors. The American Electroplaters' Society assumes no responsibility for them.

Articles appearing in this publication may not be reproduced in full or in part without express permission of the Managing Editor.

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916.

More complete corrosion of anodes by using the HARSHAW ANOCAP

The Harshaw Anocap is a rubber electrode assembly protector. Easily slipped over the anode hook and down over the anode top, the Anocap enables you to corrode an additional 2 to 4 pounds of metal from each anode.

Many more time and money-saving benefits are yours in the inexpensive Harshaw Anocap:

1. More usable metal—less recasting or scrap loss.
2. Shorter stub—easily placed directly into anode saver basket and consumed.
3. Anode hook protected, thus giving it longer life.
4. With Anocap in place on hook, anode can easily be screwed on or removed from hook.
5. Anocap pays for itself during first use.
6. Entire anode can be below solution level. Shorter anodes can be used and thus a larger quantity of anodes can be obtained from any given poundage of anode metal.
7. When using Anocaps, solution level of bath is not critical.
8. Anocaps can be used with any standard oval anode.

You'll make new savings on anodes tomorrow if you order Harshaw Anocaps today. Send or call in your order to the nearest Harshaw sales office.

THE HARSHAW CHEMICAL COMPANY

1945 East 97th Street • Cleveland 6, Ohio

Chicago 32, Ill. • Cincinnati 13, Ohio • Cleveland 6, Ohio • Houston 11, Texas • Los Angeles 22, Calif.
Detroit 28, Mich. • Philadelphia 48, Penna. • Pittsburgh 22, Penna. • Hastings-On-Hudson 6, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 402.

EDITORIAL

THE ANSWER LIES WITH YOU

WAY BACK in our world's medieval era, back nearly a thousand years in the path of time, those who belonged to a particular trade or calling banded themselves for the first time into veritable protective unions popularly termed guilds. That time's candle makers are example in point. Their statute dated from 1061 and, like the others had a sole objective—to impede anyone from practicing the trade who had not duly been admitted into the union.

Today, nearly a thousand years later, crafts and trades and professions—craftsmen and tradesmen and scientists—are joined together in modern associations and societies. Contrary to the medieval, however, the modern such body's mission is to encourage admittance of the qualified into the fold. It is to enrich their knowledge. It is to assimilate them within the framework of the great common purpose of individual betterment and therefore collective betterment. Greater collective prestige and reputation, in turn, means greater public good will, a priceless asset.

Among a host of such associations and societies is your own American Electroplaters' Society (AES). Under its banner, nearly 7400 scientists, technicians, practical platers and others related to electroplating, metal finishing and allied arts are united for self-betterment and for betterment of the science of plating and metal finishing.

Among the many tools for self-betterment provided to its members by the AES and its 55 Branches here and in Canada and Australia is a well-planned, popularly-priced, versatile Annual Convention. Scheduled for June 16–20 in picturesque Montreal, the so-called "Paris of the New World," this year's 44th Annual Convention promises to be one of the most effective enterprises in the Society's nearly half-century history.

Montreal's Sheraton-Mount Royal Hotel will house the AES assembly. Two other equally renowned hotels will accommodate much of the 2000 expected attendance. Greater technical knowledge will be courted not only by 23 quality papers delivered at six Educational Sessions but also by group visitations of four of Canada's mammoth industrial operations.

Membership relations will be enhanced via banquets, cocktail parties, dances, receptions, athletic events and sport tournaments. An outing into the majestic Laurentians will be a Convention highlight. A vaunted four-day Ladies' Program should make the Convention a memorable occasion for AES ladies. Business Sessions of the Supreme Society and meetings of the AES's standing and special committees will aid in furthering the best interest of the Society.

The accomplishment of the Convention's mission will largely depend upon the Active Members. Your presence and your wholehearted participation should not only result in self-betterment but also AES's further progress. The answer lies with you.

John P. Nichols

Executive Secretary

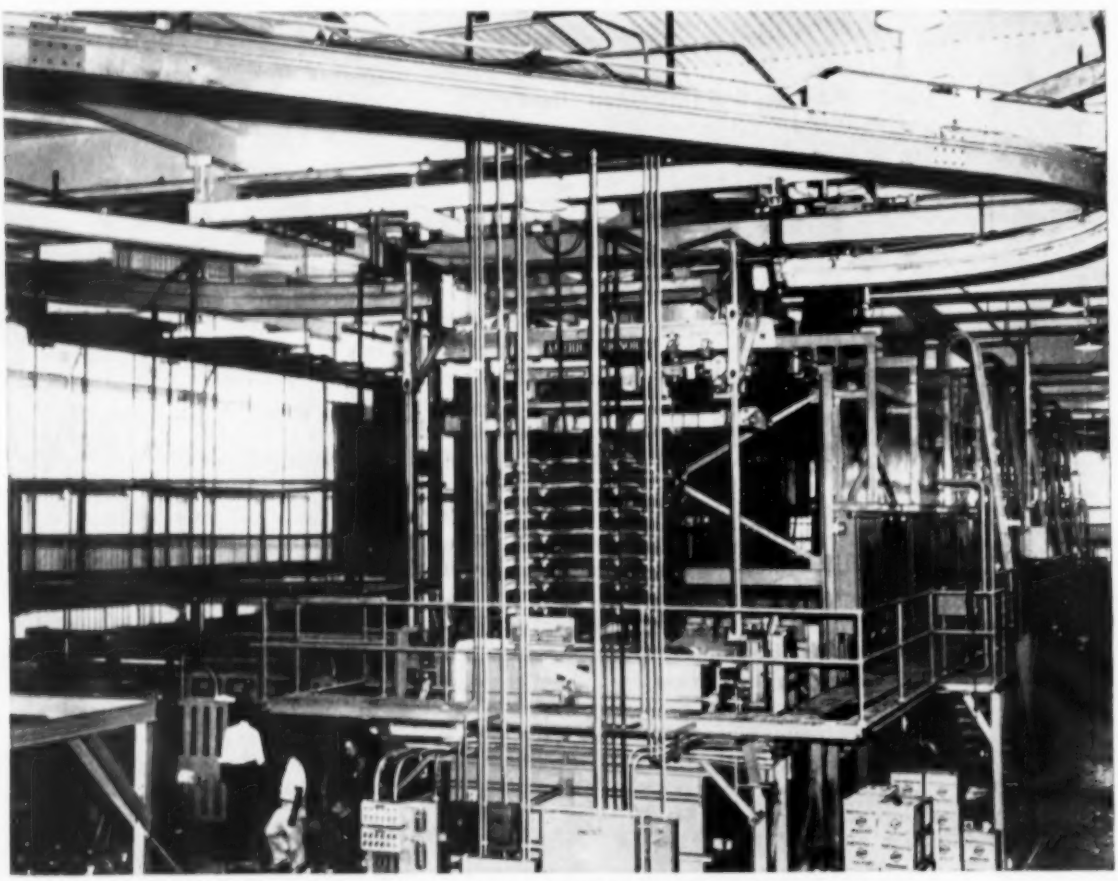
(Advertisement)

Udylite Builds Largest Plating Installation On West Coast

IN an orange grove setting, near Fullerton, California, Rheem Automotive Company now has in operation the largest plating installation on the West Coast. It was designed and built by the Udylite Corporation under the supervision of the L. H. Butcher Company Division. Udylite furnished a complete "package" for the cleaning and plating facility.

Rheem manufactures the complete bumper right from panels of high tensile steel. Before plating, these panels are pickled, polished, bonderized, rinsed, formed, and then transferred by an overhead monorail system to the plating department. Here, in an area the size of a football field, the bumpers travel through thirty-one operations.

Upon arrival at the plating department, ten to sixteen bumpers are placed on each rack in a floor level racking area. The racks, mounted on work carriers, are delivered automatically to the Udylite pre-plate unit by



Bumpers loaded on plating racks are automatically transferred through this seventeen tank pre-plating unit giving chemically clean surfaces prior to nickel plating.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 403.

Lineup of 5,000 ampere, 18 volt Udylite-General Electric Germanium rectifiers (right) and Inductrol automatic voltage regulators are shown mounted on overhead catwalk.

the monorail system. This automatic machine is 133′ long x 15′ wide x 22′ high. It operates hydraulically and routes the work through a pre-plate cycle as follows: 1) Load and Soak Clean; 2) Electrolytic Clean; 3) Cold Rinse and Spray; 4) Anodic Acid; 5) Cold Rinse and Spray; 6) Electrolytic Clean; 7) Cold Rinse and Spray; 7A) Drain and Transfer; 8) Acid Dip; 9) Cold Rinse; 10) Nickel Strike; 11) Cold Rinse; 12) Acidified Rinse.

After the cleaning and surface preparation, the work carriers with their racks of bumpers are delivered selectively to either of the two nickel plating lines where they are then placed in the nickel plating tanks on a predetermined time cycle.

The nickel line consists of two sections; each composed of sixteen tanks; twelve contain nickel plating solutions. Each nickel plating tank has conforming anodes and cathode bar agitation and contains, 3,750 gallons of solution which is continuously filtered and heated by heat exchangers. Each tank is powered by a 5,000 ampere, 18 volt Udylite-General Electric Germanium rectifier with automatic stabilized voltage control.

Work carriers are picked up at the end of the nickel line and are transferred to inspection stations by means of the continuous monorail system, prior to final chromium plating.

After inspection, work carriers are automatically delivered to the chromium plating line and handled by a manually operated monorail system through a series of ten cleaning, rinsing and chromium plating tanks.

Then, after chromium plating, the work carriers are automatically picked up and delivered to an unloading area where the plated bumpers are removed for inspection and palletizing.

When the plating operation is completed and the racks have been emptied, the work carriers and racks are routed through an electrolytic rack strip tank which contains 31,000 gallons of solution. The stripped racks and work carriers are transferred back to the loading area ready to again go through the cycle.

There are other features of interest concerning this large installation. Solutions are heated by steam from two cross-drum type boilers of 500 H.P. capacity. Temperatures on all processing solutions are closely controlled by special thermostatic devices.

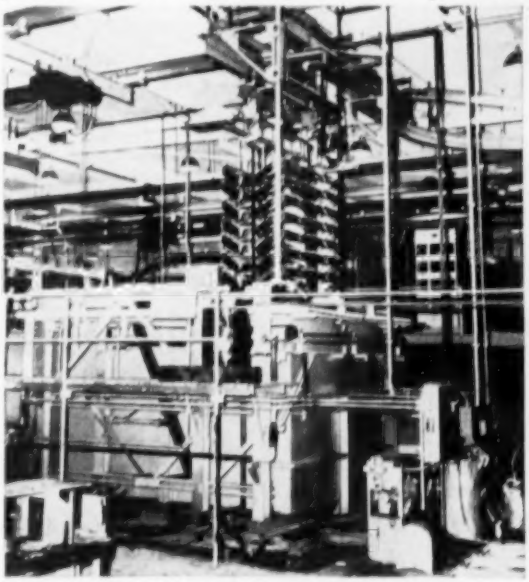
Koroseal, Plastisol or Neoprene tank linings are used wherever acid or other corrosive conditions are encountered. Giant fans and water-wash fume exhausters remove fumes and vapors from processing tanks.

Udylite-General Electric Germanium rectifiers were selected for the new Rheem Automotive bumper plating line. These rectifiers produce 160,000 amperes of direct current. It is believed to be the largest installation of germanium rectifiers in the plating industry. The 15 and 18 volt, air cooled units were selected by Udylite electrical engineers and built in the General Electric Rectifier Department at Lynn, Massachusetts. All are equipped with Inductrol automatic regulating control making possible automatic voltage or current stabilization. Units are housed in 5,000 ampere cubicles, with 18 of these mounted on the mezzanine floor to power nickel plating tanks. These 18 volt units are easily accessible from the nickel line catwalk. Two 15,000 ampere and two 20,000 ampere units, each rated at 15 volts, are floor mounted.

The 5,000 ampere cubicles, because of their compact size and light weight, enabled a "building-block" arrangement designed for maximum installation flexibility and ease of maintenance. Each cubicle contains three blowers, five power trays and five transformers. Germanium cells are hermetically sealed from the plating room atmosphere to prevent corrosion.

As an added safety feature, a protective device is incorporated in each unit, which first gives a warning signal when current or temperature limits are exceeded and finally shuts the unit down automatically before damage is done.

These germanium plating rectifiers have a full load efficiency as high as 85 per cent, resulting in reduced power costs, according to Udylite rectifier specialists.



A plating rack load of chrome plated automobile bumpers is being removed from the last operation of the chrome plating line by the automatic overhead monorail system.

L'HOMMEDIEU
Everything for Plating and Polishing

Manufacturers of

"RELIANCE" PRODUCTS

— since 1898 —

The most complete line of electroplating and polishing equipment and supplies

TYPE L—DOUBLE ACTION BARREL FOR ABRASIVE TUMBLING OR BALL BURNISHING

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.

RELIANCE SELENIUM RECTIFIERS

Designed for all metal finishing operations.

High power factor and low ripple.

6 to 48 volts D.C.

Basic-self-contained or with Remote Control.

No. 18 VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls—ball-bearing throughout. Powered by two up to 15 H.P. motors. Adopted by leading manufacturers as standard equipment.

Write for descriptive literature and prices

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS of

Plating and Polishing Machinery

Complete Plating Plants Furnished

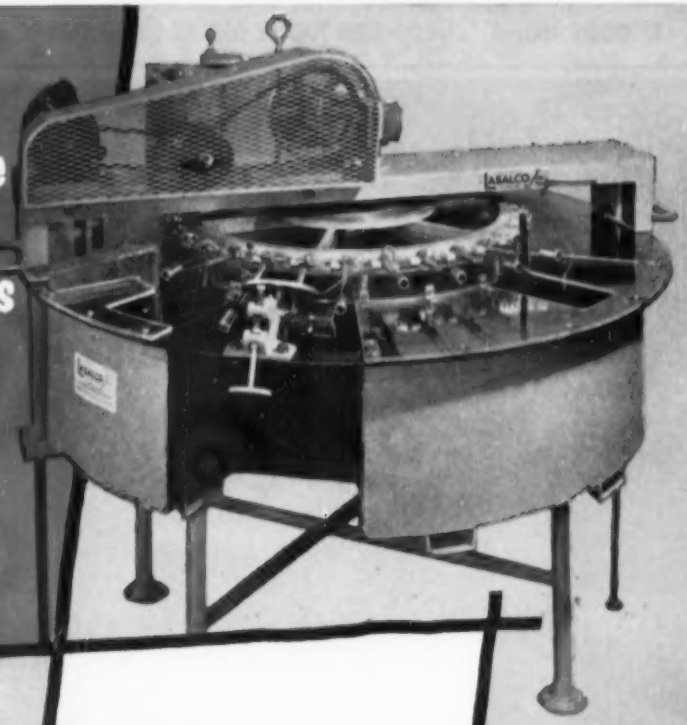
Chas. B. Little Co.
Newark, N. J.

W. R. Shields Co.
Detroit, Mich.

Gen. Office and Factory:
4521 Ogden Ave.
CHICAGO

Branches:
Cleveland
and
Los Angeles

Chrome Plate over 3200 Pieces Per Hour with One Operator!



LASALCO's *New* CIRCULAR CHROME PLATER

Cost-cutter . . . time-saver . . .
production-booster! Consider the unusual extra profit possibilities with this new high current density, continuously-moving cathode chrome plater:

- Exceptionally high output—3290 pieces, up to 3" long, per hour at 23 seconds. Minimum output, 530 pieces per hour at 2.39 minutes. (Alternate slower drives for heavier plating.)
- One-man loading . . . fully automatic unloading.
- No racks . . . no rack upkeep.
- Easily removable sectionalized cover of Plexiglas, plus easy-to-raise driving mechanism and cathode wheel, gives quick access to coils and anodes. Parts falling into tank are instantly recoverable.
- Simple installation requires only electrical connections and exhaust duct. Plater delivered complete, ready to install.

Write Now . . . Get The Facts About This Money-Maker

SPECIFICATIONS

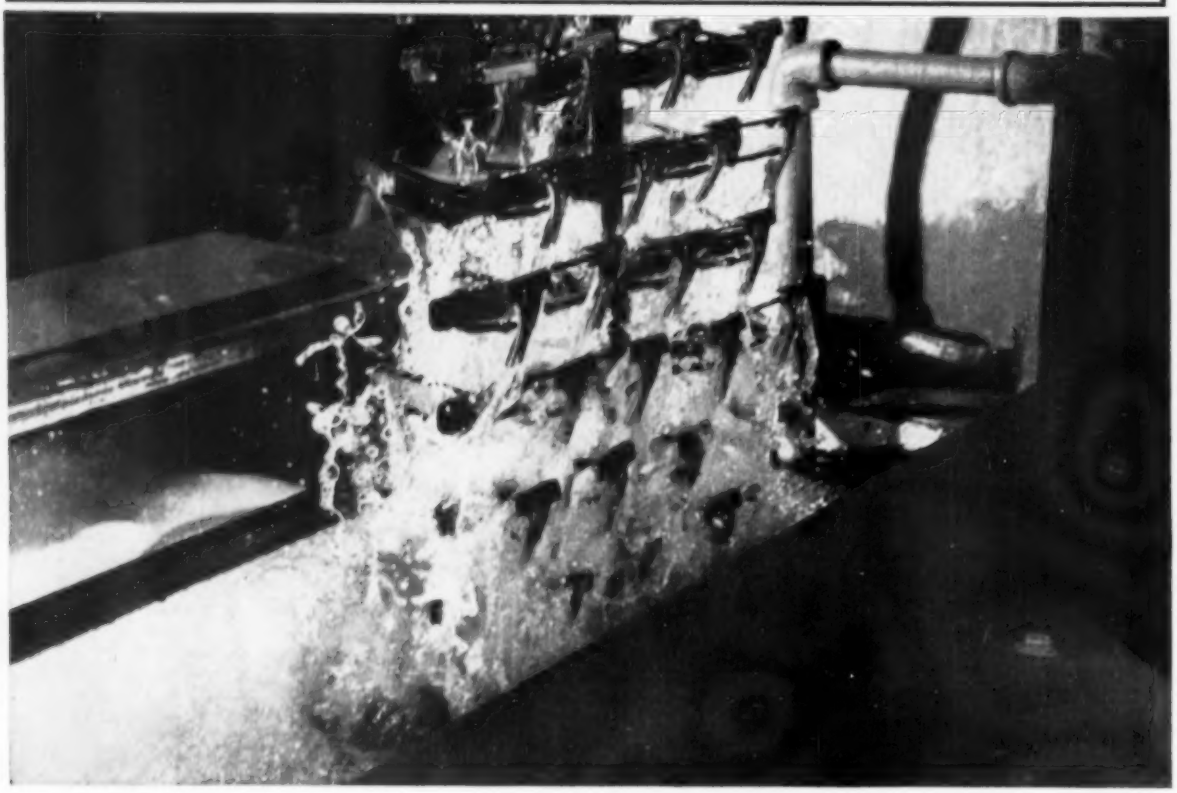
Cathode Wheel Diameters 30", 31
Bronze Work Carriers 3.24" O.C.
Effective Plating Travel 58.4".
Inner Anode Diameter 24"; Outer Anode 40".
Center Of Anode To Cathode 4".
Tank Diameter 54"; Depth 14".
3/32" Koroseal Lining.
Solution Capacity 115 Gals. 2" From Top.
Anodes: Flat 16 lb. 6% Antimonial Lead—Outer ¼"x9"x7'5"; Inner ¼"x9"x4'4". Anode and Cathode Taps ⅛" x 2". Copper Bars.
Bused For 500 Amps.
Heating (Standard): ¾" I.D. 6% Antimonial Lead Steam Coil. (Available For Electric Heating.)
Drive: ⅓ HP 110/220 1- Phase 60 Cycle AC Motor. Variable Speed Reduction.

LASALCO, INC.

HOME OFFICE
2820 LaSalle St. • St. Louis 4, Mo.
PRospect 1-2990

IN TEXAS
801 West Eighth St. • Irving (Dallas), Tex.
Phone: 3-4921

REPORT NO. 6 / ON LOWERING TODAY'S COST OF PRODUCTION



Soak cleaners that eliminate solvent pre-treatment on most work

Step up production, lower cleaning costs

Faster, more efficient production often hinges on quick-working compounds and a minimum number of production steps.

Diversey heavy duty alkaline soak cleaners No. 404 (for brass and steel) and No. 909 (for all metals), save up to 50% of present cleaning costs *on most work* by eliminating solvent dips . . . eliminating hand cleaning and wiping . . . eliminating vapor degreasing. Fast, thorough, non-caustic cleaning action removes quenching oils, buffing compounds and other soil, making solvent pre-treatment operations unnecessary.

Instant wetting completely penetrates foreign matter and starts the cleaning action as soon as work is emerged. Soil is rapidly broken up and dispersed throughout the solution. It *will not cling* on draining work. Since Diversey soak cleaners work so quickly, they are well geared to the demands of automatic equipment having short cleaning cycles.

The cleaning and draining efficiency of Diversey soak cleaners often bring unthought of economies. Dramatic proof of this performance superiority is, *in some plants*, work passes from No. 909 solutions *directly* into electro-cleaning baths without the need for an intermediate rinse! Of course, many operations require a rinse . . . in those cases, both No. 404 and 909 rinse waterbreak-free.

Both cleaners are absolutely safe on recommended metals. Even highly active metals such as aluminum are cleaned safely and with ease by No. 909.

There's an added margin of safety for your men also. Both No. 404 and No. 909 are mildly alkaline, non-toxic and non-caustic. They will not sting, burn or cause dangerous skin irritation.

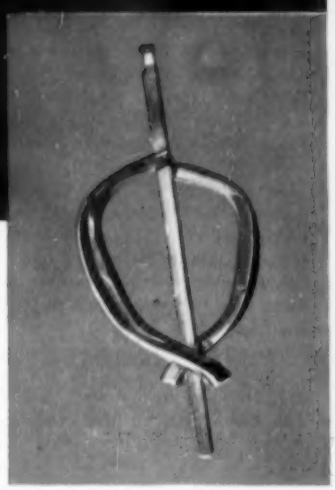
For literature on these two products, write today to *Metal Industries Department, The Diversey Corporation, 1820 Roscoe Street, Chicago 13, Illinois.*

PLANTS IN CHICAGO, NEWARK AND SOUTH GATE, CALIFORNIA. WAREHOUSES IN PRINCIPAL CITIES.

DIVERSEY.® **SOAK CLEANING**

WAGNER ISO-BRITE COPPER . . .

"The efficiency of your new Iso-Brite Copper bath will enable us to put a $7500 'semi' to work on other jobs. We get a deposit of .0005" in a 15 minute cycle and could easily get .0006" to .0008" if required. Iso-Brite needs less maintenance than any bath within our experience." (Robert Hilfinger, Pres. Hilfinger Corp. to Jos. R. Wagner.)



Die cast automotive grill part ready for nickel and chrome.

doubles

SEMI-AUTOMATIC PLATING!

CONVERSION TO ISO-BRITE ELIMINATES ONE MACHINE . . .

The record at Hilfinger Corp., Toledo, Ohio, tells a simple story. This big, 115,000 sq. ft. die casting plant with a 200-man plating department originally required two semi-automatic plating machines for plating copper before nickel and chrome on large automotive die castings. New Wagner Iso-Brite Copper bath was installed eight months ago in one tank, replacing a leading proprietary copper bath, both machines being operated by a single generator. Excessive burning of the competitive plate resulted. The single machine charged with Wagner Iso-Brite Copper now turns out Hilfinger's entire production requirement to the customer's specification, permitting the surplus semi-automatic to be devoted to other production.

If reducing finishing costs is of interest to you, consider these reasons why this new Wagner-processed chemical is making records everywhere:

Wagner Iso-Brite Copper offers

1. Ease of control
2. High anode efficiency—copper cyanide additions virtually eliminated
3. Much heavier plate
4. Fine grained, dense, ductile, fully bright
5. Freedom from roughness
6. Wide operating range—temperature 135-165°; up to 60 amperes per square foot
7. High tolerance of organic contamination

Wire, phone or write for Bulletin 70.2 for full technical information on Iso-Brite Copper and the Wagner cadmium and zinc brighteners and chromate finishes. Please pass this advertisement along to your purchasing agent or plating superintendent. The Wagner man in your area will assist you with any plating problem.

425 MIDLAND AVE., DETROIT 3, MICHIGAN

CHICAGO • CINCINNATI • CLEVELAND • INDIANAPOLIS • NEW YORK • ROCHESTER • GRAND RAPIDS

Wagner BROTHERS INC.

INDUSTRY NEWS

Army Engineers Assisting in Developing Satellite—The Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Va., is assisting in the development of the first man-made satellite for "Project Vanguard."

Dr. Georg Hass, chief of the Physics Research Laboratory, has been assigned the task of both developing and applying a coating for the sphere to be sent into outer space.

Purpose of the coating is three-fold: Give high reflectance to light to minimize heating by absorption of sun radiation; act as a highly absorbing surface in the infrared to stabilize temperature by high radioactive power in the infrared; and prevent corrosion of the magnesium surface.

It is proposed to first coat that magnesium with chromium, then with aluminum for high visible reflectance, and finally with silicon monoxide, which is expected to form a more strongly adhering coating than would silicon monoxide directly on magnesium. It will also protect it from oxidation. Magnesium samples have been coated with the proposed film combination and have shown the desired properties.

DeVilbiss New West Coast Headquarters—A new specialized structure was recently completed in Los Angeles as West Coast headquarters for the DeVilbiss Co., manufacturers of spray finishing equipment. It is now in operation as sales and service center, rebuilt exchange and warehouse unit and offers a customer research laboratory equipped with facilities for demonstration and testing of spray applications of all kinds for DeVilbiss users and prospective customers. The new branch, five times the size of former quarters is located at East Slauson and South Garfield Avenues near the Santa Ana Freeway.

Experimental Center—A new research and experimental center for barrel finishing of metals and plastics was recently opened by the Lord Chemical Corp., 2068 South Queen St., York, Pa.

The 40- by 120-foot plant addition contains an experimental tumbling room, chemical laboratory, office, sample-storage space, and a modern display room.

Research Partnership—Formation of a research partnership between Ionics, Inc., of Cambridge, Mass., and Diamond Alkali Co., Cleveland, Ohio was announced by Raymond F. Evans, chairman and chief executive officer of Diamond.

This new partnership represents "a major extension of our Company's research activity," Mr. Evans explained. "Under the arrangement, Ionics will devote all of its uncommitted research efforts to Diamond's interests. It is expected that Ionics will work substantially independently for Diamond's interest on projects suggested by both Ionics and Diamond.

Dr. Gilliland, president of Ionics, said that Ionics will undertake under the sponsorship of Diamond substantial and varied chemical research programs, including applications of ion exchange membranes developed by Ionics. This research will be done in Ionics' Cambridge facilities, but company personnel will work closely with Diamond's Research and Development staff at Painesville, Ohio.

Name Change—Dr. A. K. Graham, president, announces that effective March 31, 1957 the corporate name Graham, Savage & Associates, Inc. supersedes the former Graham, Crowley & Associates, Inc. The change, Dr. Graham states, represents a more active participation of Frank K. Savage in the company's consulting, engineering and research activities, following the resignation of Dr. C. A. Crowley in 1954. Mr. Savage, who has been vice president of the firm since 1948 and in charge of the company s Kalamazoo, Michigan, office and pilot plant, also becomes a member of the Board of Directors.

Mr. Savage, who is a Past President of the American Electroplaters' Society and long active in work of the society's Research Committee, is President and owner of Savage-Rowe Plating Co., Kalamazoo. This company's facilities include the pilot plant activity of Graham, Savage & Associates, Inc. and, to integrate Graham, Savage and Savage-Rowe interest as particularly related to electrochemical research and development, Dr. Graham is vice president of Savage-Rowe Plating Co.

Larger Quarters—As part of the rapid expansion of industry in Canada, Metal & Thermit-United Chromium of Canada, Ltd. is expanding its facilities from Emily St., Toronto to bigger, more modern quarters at 36 Factory St., Rexdale Ontario.

Automation Products Plant—Having outgrown its present facilities at 5200 Pulaski Ave., Philadelphia, Pa., the Automatic Temperature Control Co. is preparing to move into its new plant located in King of Prussia, Pa., next to the Valley Forge National Historical Park. The move to the new location is planned for July or August of this year. The 74,000 square foot building will provide ATC with modern and efficient facilities for manufacturing, engineering, and research, plus general and administrative offices. New and modern machinery will be installed in a layout designed to give the ultimate in quality controlled efficient manufacturing.

Beckman Expands—The Scientific Instruments Division of Beckman Instruments, Inc. has announced plans for a new $1,500,000 research and development building which will add 100,000 square feet of working area to the present division plant and corporate headquarters in Fullerton, Calif.

Construction of the unit, scheduled for completion October 1, will permit expansion of the employee force from 1000 to between 1500 and 1700 persons.

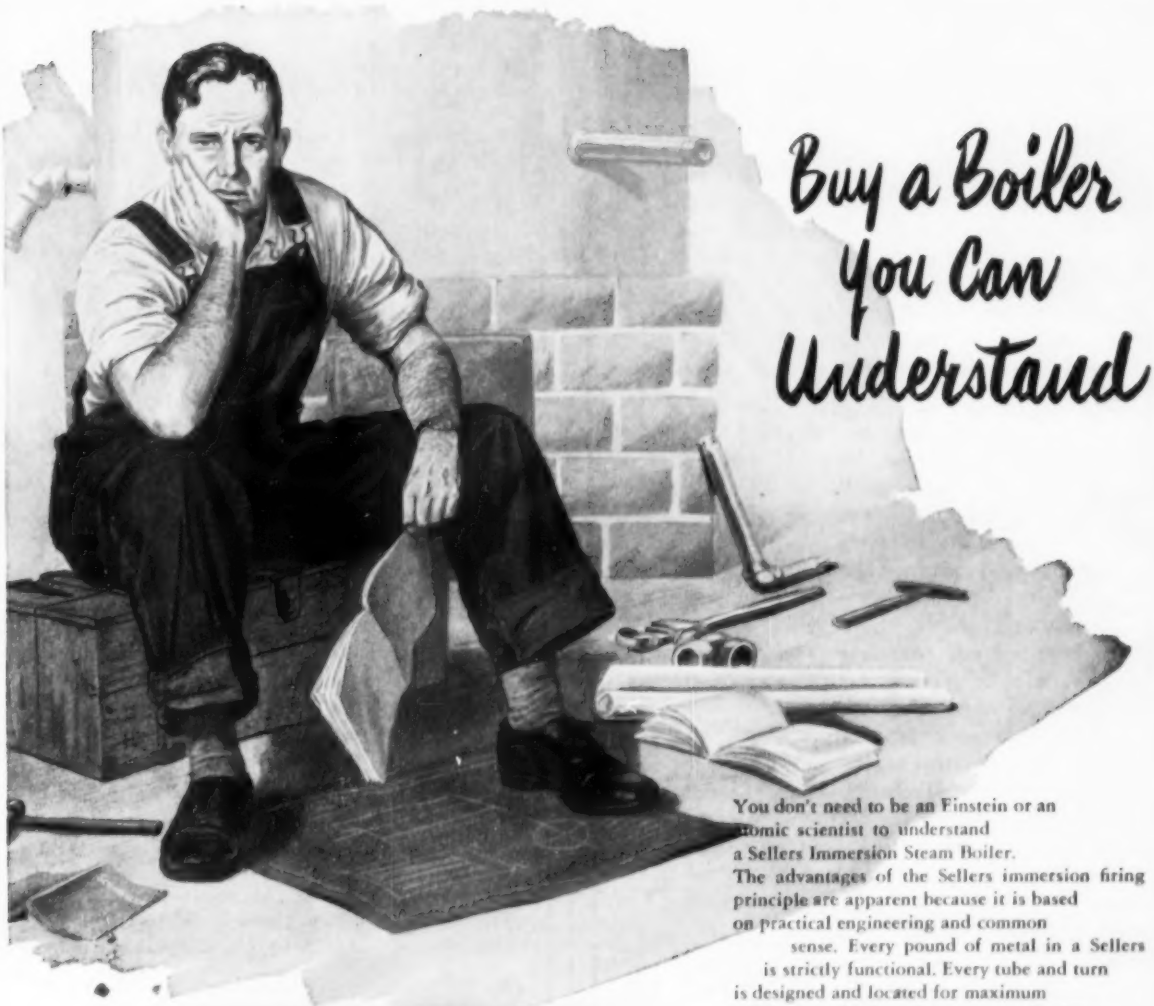
The new building will lie parallel to the present 100,000-square-foot research and production building. Joined at the east end, the two structures will form a huge U with a landscaped mall in the center, and the original wing will be devoted exclusively to manufacture.

New Du Pont Plant—A new, modern sulfuric acid plant will be built on Du Pont Company's present plant site at Ecorse, Mich., and will replace an existing plant which has become obsolete.

The new unit will substantially expand production over the present facilities and will enable the company to meet increases in customer demand for sulfuric acid. Operation of the new facility known as the Ecorse Works is not expected to require any increase in employment.

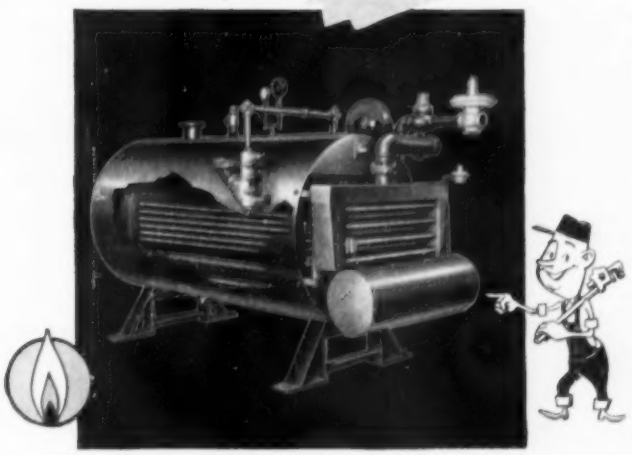
Present production of sulfuric acid will not be interrupted, since the old plant will not be dismantled until the new plant is in operation. Construction will begin next month and the new unit is expected to be in operation early in 1958.

Conference—The Spring Sales Management Conference of Kelite Corp., Los Angeles, Chicago, Dallas, Berkeley Heights, N. J., and Toronto, manufacturers of industrial chemicals and steam cleaning equipment, was held January 12 and 13 at a Phoenix, Ariz., resort.



Buy a Boiler You Can Understand

You don't need to be an Einstein or an atomic scientist to understand a Sellers Immersion Steam Boiler. The advantages of the Sellers immersion firing principle are apparent because it is based on practical engineering and common sense. Every pound of metal in a Sellers is strictly functional. Every tube and turn is designed and located for maximum efficiency and safety, for steam production at lowest cost!



IN A SELLERS:

1. **Firing tubes are completely submerged. All the heat goes directly into the water. Maximum heat transfer. No water line corrosion.**
2. **Water surface area is nearly three times that of a conventional boiler of comparable capacity.**
3. **There is no separate enclosed combustion chamber. No explosion hazard, no brick linings to replace, no carbon traps.**
4. **Expansion and contraction of firing tubes effectively combats scale.**

Sellers Immersion Steam Boilers are available in twelve sizes to meet all standard requirements. All are built to A.S.M.E. Power Codes. It will pay you to get the complete Sellers story. Write for bulletin No. 1206C-P-4 today.

Sellers ENGINEERING CO.

4876 N. CLARK STREET CHICAGO, ILL.

Blast Heaters • Immersion Automatic Water Heaters • Combustion Units • Industrial Gas Burners
Vertical Steam Boilers • Immersion Tank Heaters • Gas Combustion Equipment

Nickel Plating As You Want It

●

Nickel barrel plating is finally receiving the attention it deserves. True Brite has been a pioneer in the development of barrel nickel plating. The correct usage of barrel nickel plating is more than blindly following a set formula given by a supplier. Versatility is important and can be best secured by the correct use of the high conductivity formulas recommended by True Brite.

●

On parts which tumble well and do not have significant deep recesses, high concentrations and temperatures enable currents of 350 to 400 amperes in ordinary plating barrels with good results giving ample plates in very short times. When cupped parts are plated and dragout losses are high, economical operation may call for a fairly dilute solution (boric acid content should be kept up) and with lower temperatures good appearance is secured in the recesses. Newer equipment with no corrodible metals under the solution can use high chloride contents and the usual contamination caused by the normally impure nickel chloride corrected by using magnesium chloride. This enables maximum conductivity. In older equipment with lead coils and some metallic parts on the barrel low chloride solutions can be used with the conductivity maintained by the use of Epsom salts.

●

In all this range of solution composition and temperatures True Brite Nickel Brightener provides bright ductile plates which can be tailored to your requirements. With only a single brightener normally necessary there are still special addition agents to suit those special needs.

●

We are not merely making claims when we say that True Brite Nickel Brightener can be used for nickel plate which is to be chromium plated. Probably more commercial installations of chromium barrels use True Brite Nickel Brightener than any other. It's easier chromium plating that way.

●

Our technical bulletin gives the details of the solutions and operating conditions. Maybe you have a special problem. If so we'd be glad to help you with it.

TRUE BRITE CHEMICAL PRODUCTS CO.
98 FALLS AVENUE OAKVILLE, CONN.

INDUSTRY NEWS BRIEFS

● Fourth quarter reports on primary production of cadmium metal brought the total output for 1956 to about 10,431,000 lb, a new record high and 6 per cent greater than the 1955 figure, according to the Bureau of Mines, United States Department of the Interior. Output of the fourth quarter was 5 per cent above that of the third quarter. Total shipments for the year were 5 per cent below those of 1955. Apparent consumption of cadmium metal in 1956 was approximately 11,211,000 lb or 7 per cent below comparable figures for 1955.

● The National Defense Executive Reserve Unit of the Business and Defense Services Administration, U. S. Department of Commerce, was increased to 271 members with the designation of 53 more industry executives as reservists. Among the executives enrolled is prominent AES member, Clarence H. Sample of the International Nickel Co., Inc.

● Establishment of a scholarship at Lehigh University, Bethlehem, Pennsylvania, as a memorial to Edward Magnuson, founder of Magnuson Products Corporation, has been announced by Ingrid Magnuson, president of the company.

The scholarship, which will be activated in the spring semester of 1957, will be awarded annually by the University to an undergraduate on the basis of need, scholarship and character.

● Production and accumulation of stocks of copper sulfate in the United States were at slightly reduced rates in December 1956 as compared with November. Shipments dropped 13 per cent and approximated production which declined 3 per cent; stocks on December 31 were 1 per cent less than on November 30.

● Stability of the lead price, sharply increased production of refined lead by primary refineries, and good overall commercial demand for lead supplemented by continued Government purchases for the National stockpile were features of the lead industry in the United States in 1956. The steel strike and the cutback in automobile production resulted in some decline in the use of lead, but total consumption during the year was only 2 per cent less than in 1955 and was larger than the average of the 5 years, 1951–55. The conflict in Egypt and blocking of the Suez Canal had little effect on the supply of lead in the United States and caused no fluctuation in the New York price, which held at 16.00 cents a pound from January 13 through December.

● Production of zinc oxide (lead-free) in the United States during December 1956, was 17,500 tons or 4 per cent above the November total. Lead-free zinc oxide production increased 900 tons to 14,800 tons.

● A 75 per cent expansion program has been completed at the United States Government-owned nickel producing facility at Nicaro, Cuba. Nickel Processing Corp., a subsidiary of National Lead Co., operates the plant for the Government. The expansion will bring rated capacity to 50 million lb of nickel per year. New equipment is presently going through trial runs.

INDICATE A 410. ➤

15 WAYS TO BETTER METAL FINISHING BY AHCO

For fast removal of buffing compounds from all metal surfaces, **Lustrebrite Liquids 35 and 58.**

For acid descaling and derusting of steel, **Ahcoloid Cleaner #210,** in convenient powder form.

For cleaning aluminum in power washers, **Ahcoloid Cleaners # 59-H-5** and **59-H-9,** low foaming with high detergency.

For alkaline derusting of steel, **Ahco Deruster # 11.**

For smooth, even deburring of metal parts, **Ahco Nuggets,** fast heavy-cutting natural aluminum oxide media — sizes from 10-mesh to large 1½" or 2" available.

For coarse cutting of steel and iron parts, **Ahco Cutting Compounds #17-B-4** and **#17-B-7.**

For low-cost bright burnishing of copper and brass, **NEW Ahco Burnishing Compound P.**

For low-cost burnishing of aluminum, **NEW Lustrebrite Liquid # 50 AF.**

For bright rolling of steel and iron surfaces, **Ahco Burnishing Compound # 44.**

For high-quality, low-cost buffing of all metals, **Ahco Liquid Buffing Compounds.**

For finishing all metals as well as plastics, **Ahco Greaseless Compounds.**

For producing bright, ductile nickel deposits in barrels, **Ahco Barrel Brighteners P1** and **S1.** (Two-brightener system.)

For phosphating steel, zinc, and other metal surfaces, **Ahcophos Compounds.**

For economical inhibiting of sulphuric or hydrochloric acid on steel and iron parts, **Ahco Acid Inhibiter.**

For fast-drying, non-film-forming water displacing from all metals, **Ahco Water Displacing Compound FD.**

All of these outstanding products are the result of the Ahco Laboratories' continuing research and development program.

[illegible] CHEMICAL CO.
[illegible] CHEMICAL CO.
[illegible], CONNECTICUT

Check blocks for FREE Bulletins you want . . . mail this ad to 30 Benedict St., Waterbury, Conn.

INDUSTRY NEWS

Taking part in the Conference were all Kelite sales management personnel from the United States, Canada and Hawaii. William Sorensen, executive vice president and director of marketing, presided.

The theme of the Conference was sales management skills and technological training, with reports made on product emphasis, product performance, and the 1957 sales forecast. At the meeting, it was announced that 1956 Kelite sales reached expected levels. Sales for 1957 are expected to show a substantial increase over 1956.

New Plant—Larry Goad & Company have recently completed a new plant and office at 9292 Watson Industrial Park, in St. Louis, Mo. This modern fabricating and tank lining shop can economically serve, considering shipping costs, anywhere in the United States. This plant is equipped with two Cleveland Tramrail Bridge Cranes for economical handling, loading and unloading of heavy tanks, coils and equipment.

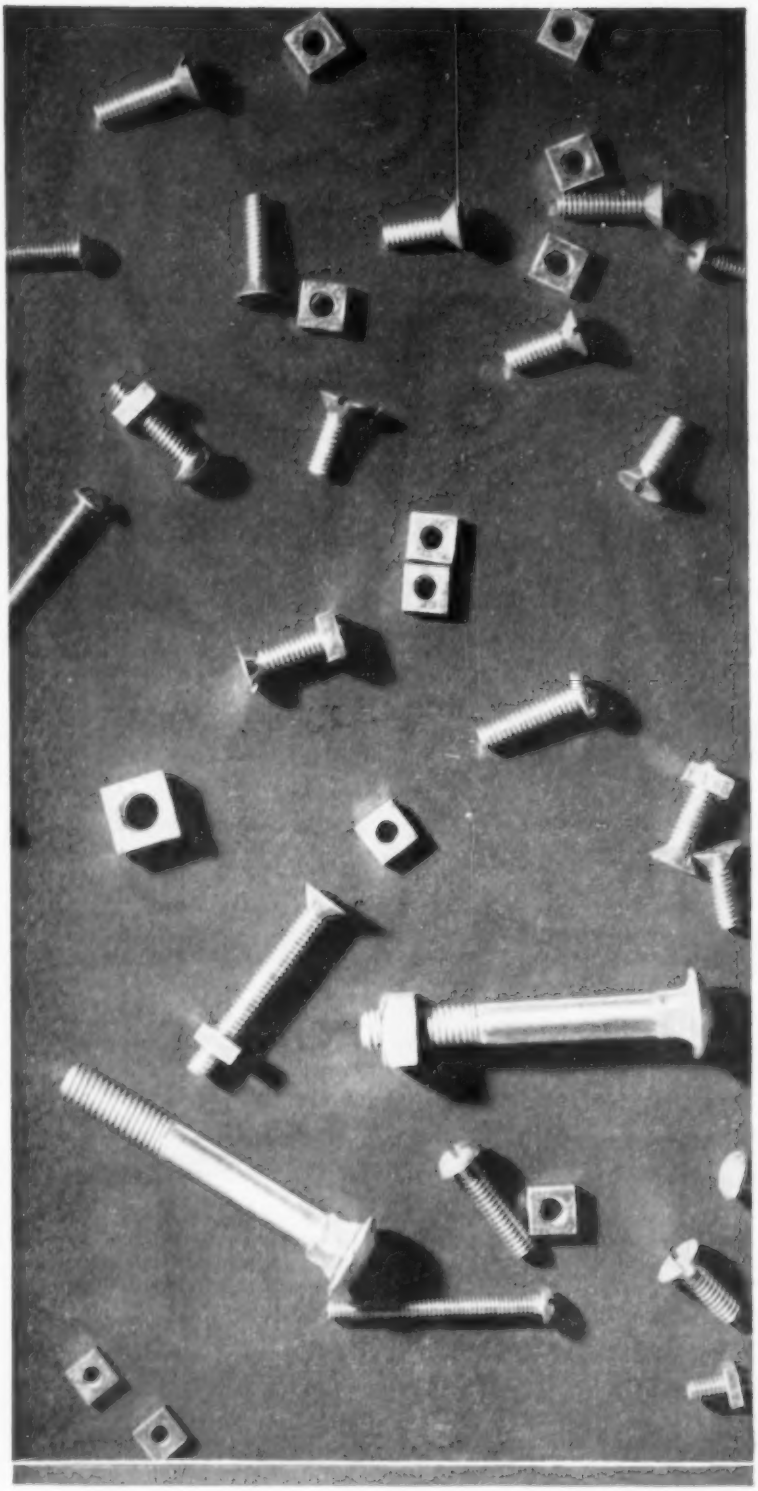
The men who comprise the nucleus of this organization have a combined total of over 30 years' experience in lead burning and the installation and fabrication of corrosive resistant tank linings and coverings. The plastic welders and fabricators of this company have a very diversified background of experience in the installation of all of the well-known plasticized polyvinyl chloride tank linings, also in the welding and fabricating of rigid polyvinyl chloride tanks, hoods, and exhaust ducts. This company also specializes in lead contracting jobs of any size or description, such as lead coils, homogeneous lead bonding, anodizing tanks and coils, cooling and heating coils, anodes and radiation protection and control in the X-ray and atomic field.

This firm is not in the plating supply business, in general, but specializes in plating equipment, such as tanks, tank linings, coils, anodes, exhaust hoods, ducts, and other equipment.

Tamms Acquires New Warehouse After Fire—A disastrous fire Jan. 15 at Tamms Industries' Chicago warehouse at 8124 South Hoyne Avenue required the Tamms management to acquire and stock another warehouse. In less than a week a new warehouse at 2035 West 58th Street, Chicago was in operation.

The fact that Tamms maintains complete warehousing service in many parts of the country contributed materially to the prompt return to near-normal operations.

Tamms Industries, Inc., main offices are at 228 North LaSalle Street, Chicago.



FEDERATED products:

Aluminum, Babbitts, Brass, Die Casting Metals, Fluxes, Lead and Lead Products, Magnesium, Plating Materials, Solders, Type Metals, Zinc Dust

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 411.

Brighter Plating at lower cost!

Competitive testing at ASARCO's Central Research Laboratory has proved that Federated Plating Brighteners will do a better job at lower cost.

CADMAX for cyanide cadmium plating, is compatible with all organic brighteners, comes with an adjuster solution to give you brilliant results, even from a new bath. No break-in is required.

ZIMAX in powder or liquid form, is most economical to use. It is applicable to every type of zinc plating operation, and is compatible with most other zinc brighteners.

NIMAX is a highly concentrated nickel brightener for use in barrel nickel plating. Five cents worth is enough for approximately 50 pounds of work. The deposit is ductile and extremely corrosion-resistant.

Send us a sample of your plating bath. Then follow the simple instructions that we give you. You'll get better results, at lower cost!

Federated Metals

ASARCO

Division of

AMERICAN SMELTING AND REFINING COMPANY

120 Broadway • New York 5, N.Y.

INDUSTRY NEWS

DuPont Increases College Grants—A fund of more than $1,000,000 for grants to 122 universities and colleges in its annual program of aid to education has been established by the DuPont Co. This support, which is for the next academic year, is a substantial increase over the $900,000 in gifts made for this year.

Nearly all of the increase and more than half of the entire program are for the improvement of teaching in universities, colleges, and high schools.

The company is awarding a total of $585,000 to nearly 100 colleges and privately supported universities to advance the teaching of science, mathematics, and other fundamental liberal arts subjects.

Grants of $4000 each have been awarded to 70 colleges which have records of strength in undergraduate chemical or technical education. Of each grant, $2500 is to strengthen the teaching of chemistry and $1500 is to aid the teaching of other subjects which contribute to the education of scientists and engineers.

For the first time, DuPont has also made grants of $4000 each to 23 major universities with which to strengthen undergraduate teaching of courses that contribute significantly to scientific and engineering education.

The third part of this phase provides $61,000 in fellowships and scholarships to encourage able young people to become high school teachers of science and mathematics.

In addition, the company awarded 98 teachers' fellowships to five institutions for the coming summer to help in-service teachers who are taking summer work for advanced degrees.

Under its longer standing plans, the company is granting $290,000 to universities for fundamental research and $165,000 for post-graduate fellowships in science and engineering.

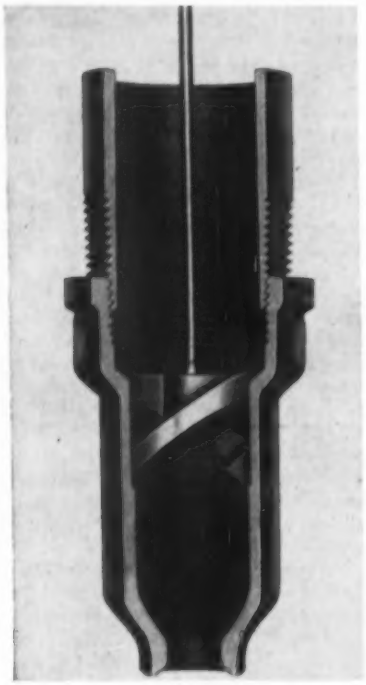
Included in the authorization for research are grants-in-aid of $15,000 each to 10 universities and $10,000 each to nine others.

There are also summer research grants of $1500 each to 20 universities.

Cowles Expands—Cowles Chemical Co. of Cleveland, Ohio, has recently completed the purchase of 20 acres of land from the River Raisin Paper Co. in Monroe, Michigan. "The future expansion of our business," R. F. Huntley, president, said, "requires production and distribution facilities in the Midwest. Marketwise, Monroe is strategically situated, and this particular site was selected because it is served not only by the New York Central Railroad, but is adjacent to the new Toledo-Detroit Freeway and has available abundant supplies of power, natural gas and water."

Equipment and Supplies

Use the convenient Reader Service Card to obtain additional information on any of these items



E—400. Pull-Out-Vane Nozzle—To simplify mounting spray nozzles at hard-to-get-at places, Spraying Systems Co. introduced a new design Fulljet Nozzle with pull-out-vane. The vane of this nozzle is made with a small female threaded connection to receive a pull-out rod, to be installed by the user in whatever length required. The rod extends back inside the pipe to some connection point that is easily accessible. When cleaning is needed the vane is merely drawn back through the pipe, removed and cleaned while the nozzle itself is flushed out.

E—401. Polishing & Buffing Lathe—The Hammond Model VRO variable speed polishing and buffing lathe can now be furnished with a special braking bar. Machines with a single brake handle are still available, but this special brake bar allows the operator on either side of the lathe to actuate it. It is an extra safety feature and a convenience and allows a man on a "sit-down" operation to operate the brake without rising, and either operator can do it.

The VRO lathe is a heavy duty production machine ideally suited to polishing, brushing or buffing operations. The spindle speed is infinitely variable between 1500 and 3000 rpm and is instantly changed by turning the speed dial mounted conveniently on top of the machine, within easy reach of the operator.

E—402. Portable Electroplater—A portable, completely automatic electroplating unit, designed specifically for electrical and other precision components, has been introduced by Sel-Rex Corp., Newark, N. J. Known as the Sel-Rex "Jet Plater," the unit is said to incorporate features and automatic equipment usually found in large, mass production electroplating installations.

Requiring only approximately 18 in. x 38 in. of floor space, in the standard 10, 20 and 30 gallon capacities, the "Jet Plater" consists of a Sel-Rex Selenium Rectifier with automatic timer; stainless steel tank (which may serve as the anode) fitted with a water jacket for temperature control; a movable work rack which accommodates a portable plating barrel; a centralized control panel equipped with Weston Ammeter and Powerstat control; a filter; and drip-proof pump with motor. It is reported that the design of the "Jet Plater" is such that larger than standard capacity units can be made easily, to individual order and specification. "Jet Platers" of 200 gallon capacities and over have already been installed by various government agencies for volume electroplating, in precious metals, of certain secret, small precision components.

E—403. High Temperature Beaker—Beakers, now being molded from linear polyethylene and having a heat distortion temperature of 250 F, are available from the American Agile Corp., Ohio.

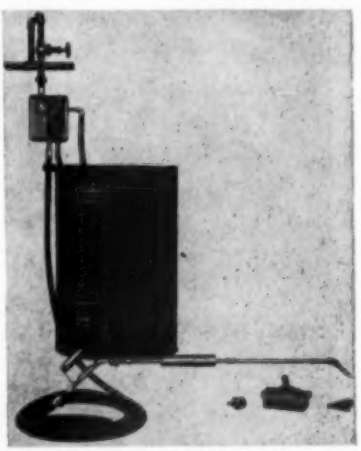
Believed to be the first beakers which may be used under temperatures of this magnitude, it also marks the first time that any company has offered these items from stock supply for immediate shipment.

Available in milliliter capacities of 250, 400, 600 and 1000, they are non-toxic, chemically inert, unbreakable and have unusually high tensile properties. They are particularly suited for industrial laboratories for handling caustic and corrosive chemicals and may be placed in steam baths to heat the contents or in autoclaves for sterilizing.

E—404. Non-Foaming Aluminum Cleaner—A new, non-foaming cleaner which removes identification inks, grease, oils, and other heavy soils from aluminum has been announced by Oakite Products, Inc.

The new material, Oakite Aluminum Cleaner No. 164, has been specially compounded to clean without foaming in agitated tanks. Even without agitation its ability to remove difficult soils is said to be excellent.

Used at 6 to 8 oz/gal of water, at temperatures between 160 and 180 F, solutions of Oakite Aluminum Cleaner No. 164 are completely safe on aluminum and its alloys.



E—405. Turco Steamerette—Development of the Turco Steamerette—an injector unit that uses existing steam supplies for steam cleaning, paint stripping, phosphating or sanitizing has been announced by Turco Products, Inc., Los Angeles. The new product is said to provide complete steam cleaning facilities for a fraction of the usual cost.

The Turco Steamerette is easily operated, requiring only the adjustment of one valve. It will operate anywhere in the range of 40–140 psi steam and has a powerful impinging force at all pressures within this range. A built-in pressure gauge indicates the operating pressure, eliminates fluctuating and assures uniform cleaning. Quantity and pressure of solution at the nozzle may be varied to provide every type of delivery, from a slow full stream at moderate temperature, to a hot driving blast for heavy cleaning.

NEW ...from Du Pont

Improved "Zin-O-Lyte" Brightener Saves Money in Barrel Plating Zinc

NEW "ZIN-O-LYTE" BRIGHTENER SPECIAL

Gives brilliant zinc deposits...right from the barrel...without a bright dip

NOW YOU can get top quality, brilliant zinc plating direct from the barrel without a bright dip, by using "Zin-O-Lyte" brightener—SPECIAL. The new formulation, fully tested in production installations, is designed specifically to cut your brightener costs with no sacrifice in quality of work.

"Zin-O-Lyte" Brightener SPECIAL is compatible with other Du Pont zinc brighteners and generally can be used without change in procedure.

The new "Zin-O-Lyte" brightener is available in non-returnable Fibrepak drums which minimize breakage . . . reduce shipping costs. This readily soluble powder also gives you freedom from freezing or settling out of brightener constituents in storage or transit.

New "Zin-O-Lyte" Brightener SPECIAL is a part of Du Pont's extensive line of plating chemicals. For complete information and arrangements for trial use in your plant, please call or write to our nearest district office or: E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Del.

DISTRICT SALES OFFICES: Baltimore • Boston Charlotte • Chicago • Cincinnati • Cleveland • Detroit Los Angeles • New York • Philadelphia • San Francisco

DU PONT *Chemicals • Processes • Service*
for **ELECTROPLATING**

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

EQUIPMENT & SUPPLIES

The new steam gun is easy to install and economical to maintain. Since there are no pumps, motors or costly complicated equipment, maintenance is minimized. The unit will not clog or overheat, even under the most adverse operating conditions. It is quickly attached to any steam line maintaining an open pressure of 40 pounds or more. Easily portable, it can be quickly disconnected for removal to other parts of the plant where its services are required.

E—406. Measuring Magnifier—Edmund Scientific Co. introduces a more compact, on-the-spot check for linear dimensions given in inches and millimeters, diameters, radii and angles. Measurements are made easily without the necessity for time consuming adjustments. There are many uses for this handy measuring magnifier, also known as a pocket comparator—in industry, in the laboratory, at the bench. Reticle can be easily removed; comparator becomes a high-power magnifier; and light is admitted to the object viewed through the transparent walls of the plastic cell at the bottom of the magnifier. This instrument gives 6 power magnification and the reticle is etched in glass.

E—407. Regenerative Demineralizer—Purification by ion-exchange to produce water with an electrical resistance of over 1,000,000 ohms per cubic centimeter is now made possible with an almost constant pH level of 7 with the new Barnstead MM-O Mixed-Bed Regenerative Demineralizer. Cation and anion resins are thoroughly

mixed in one resin bed thus permitting the ion-exchange process to take place hundreds of times as the water flows through.

The manufacturer states that Model MM-O removes approximately 1100 grains per regeneration. Unit consists of transparent plastic column mounted on a plastic base with molded plastic fittings top and bottom and is shipped as a complete unit with plastic tubing and distributor which aids in regenerating resins. Base is 8 in. x 8 in. and height is 51 in. Flow rate is from 10 to 30 gal/hr.

E—408. Cleaning Machine—A new automatic work and tote pan cleaning machine announced by Ransohoff, Inc. does the work of two machines, saves 50 per cent on floor space, prevents mixing of work and reduces manual handling. Designed and installed in a nut and bolt manufacturing plant, the machine is widely adaptable for any parts handled in tote pans, boxes and similar containers.

The machine receives tote pans of work, dumps the work into a drum type washing

The Leading Name in Immersion Heating

THERE'S A Glo-QUARTZ* IMMERSION HEATER for YOUR EVERY HEATING REQUIREMENT

All 3 Types

- INSTANT HEATING
- SHORT-PROOF
- AVAILABLE IN ALL VOLTAGES—WATTAGES, one and three phase
- STOCKED FOR IMMEDIATE SHIPMENT

TYPE "U" PATENT PENDING World's first successful U-tube **ACID** Heater—Guaranteed to outperform and outlast all other quartz heaters.

TYPE "GN" Pat. No. 2,740,881 Standard straight tube Quartz **ACID** Heater—Vapor-proof junction box; replaceable heating element.

TYPE "MB" "Multi-Blade", Metal-sheathed **ALKALI** Heater—Portable, burn-out proof, easy mounting, long life.

WRITE FOR BULLETIN

If you're looking for
ACCURACY—EFFICIENCY—LONG LIFE—and ECONOMY
...you'll get it with Glo-QUARTZ!
Available from your Electroplating Distributor!

Glo-QUARTZ ELECTRIC HEATER CO., INC.
*Trademark Reg. U.S. Pat. Off. WILLOUGHBY, OHIO Phone: Willoughby 2-5521

section, then carries the upside down tote pan through an integral conveyor type washing section above drum section where work is processed. Both work and tote pans are washed, rinsed and dried. Tote pans return to the discharge end of the machine ahead of the parts they formerly contained. Then the clean, dry batch of work is loaded, automatically, into the same, clean and dry tote pan.

This particular machine was designed and built for a wash, rinse and dry sequence but the machine can incorporate any combination of cleaning, pickling, phosphate coating and similar operations. Processes unnecessary for the tote pans or other containers would be eliminated in the conveyor section.

E—409. Rectangular Panel Instruments—A new line of rectangular panel instruments of modern design and styling has been announced by the Simpson Electric of Chicago.

Called the "Wide-Vue" line, the new instruments feature an open-face design and longer scale lengths. The 2½ in. size, for example, has the same scale length as a conventional 3½ in. panel instrument. The open-faced cover is designed to permit wide-angle readability of the instrument scales.

"Wide-Vue" panel instruments are custom-built in 2½, 3½ and 4½ in. models with any practical range, ac and dc. The durable plastic cover is formed in one piece and can be supplied in black or color finishes to match customer's equipment. Two movements are available—Simpson's standard magnet type, or the *self shielded* core magnet meter movement. Special scales in the customer's own style also can be supplied.

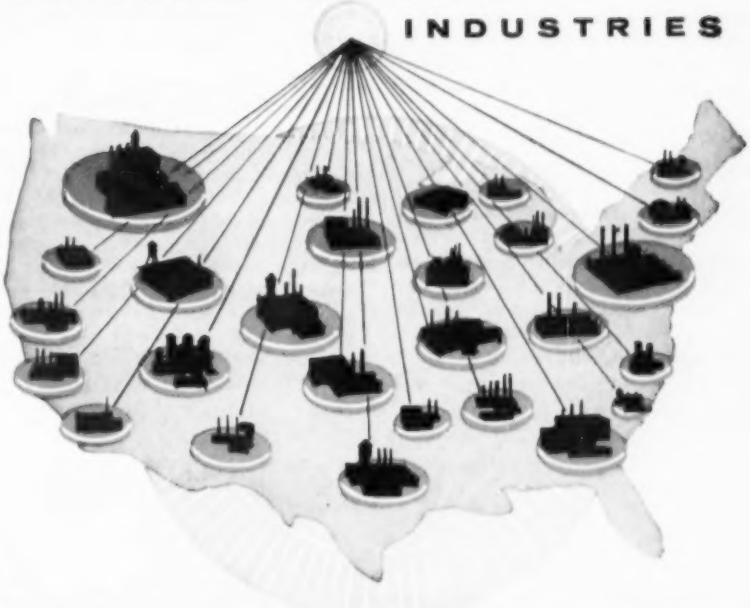
E—410. Buffing Compound Detergent—Kenvert Stuff-Off, a new synthetic detergent produced by Conversion Chemical Corp., Rockville, Conn. is designed to remove buffing compounds by its unique anti-staticising and synergistic properties of wetting the metal surface and reducing interfacial tension between metal and compound. Its unusual properties permit the compound to slough off in sheets.

The detergent is suggested for use on either ferrous or nonferrous metals, and works equally well in hard or soft water areas. Ferrous parts treated in this new detergent have a tendency to resist rusting. It is also recommended for tubbing processes in the jewelry field, and further as a burnishing compound for zinc die castings.

Choice of the Nations

BLUE CHIP

INDUSTRIES



MEAKER ENGINEERED PLATING EQUIPMENT

Meaker equipment is used for efficient and economical plating by many of the nation's most important builders of such products as automobiles, appliances, machinery, furniture and many others. When they install Meaker engineered equipment they are assured that it is designed to meet specific requirements. They are also certain that Meaker will stand behind the equipment during its whole operational life, making sure that it produces the best possible plating job at reasonable unit costs.

Meaker has accomplished much for other manufacturers. Why not find out what we can accomplish for you? Our engineers will be happy to survey your problems with you and recommend the equipment you need. Call or write today!

THE MEAKER COMPANY

1633 SOUTH 55th AVE. • CHICAGO 50, ILLINOIS • Phone OLympic 2-2110

● Full Automatic and Semi-Automatic Plating Machines ● Strip Steel Plating Equipment ● Wire Galvanizing Equipment ● Batch Type Plating Machines ● Pickling Machines ● Motor Generators for Plating ● Processing Conveyors ● Rectifiers for Plating

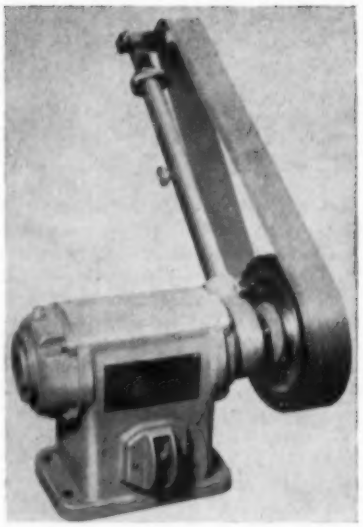
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 415.

EQUIPMENT & SUPPLIES

E—411. Chemical Resistant Lining—A new plastic lining material exhibiting extreme chemical resistance to acids, alkalis, oxidents, and most solvents has been announced by The United States Gasket Co. of Camden, N. J., a division of The Garlock Packing Co., Palmyra, N. Y. The new material, Kel-F, is a plastic laminate, and can be cemented to any surface with almost any contour by non-technical and semi-skilled personnel. The non-toxic and non-contaminating material has a temperature range of +350 F to −100 F and, in addition to being completely corrosion resistant, presents a non-wetting and non-sticking surface with excellent abrasive resistance.

The new Kel-F plastic laminate is ideal for lining tanks, vessels, reactors, drums, pails, pipe, shoots, hoppers, fume hoods, and ducts. It is also suitable for surfacing laboratory bench tops, floors in chemical plants, conveyor belts, resin casting forms, rolls, and decks exposed to extreme corrosive conditions.

E—412. Bench Grinder—The Curtis Machine Div. of The Carborundum Co., Jamestown, N. Y. has announced the addition of the new Model DBA-O Bench Grinder to their line of Abrasive Belt Machines. This lightweight, compact grinder is available in both single or three-phase current. The 6 in. diameter, 2 in. wide contact wheel is driven by a 0.6 hp motor developing a speed of 5100 sfm. By use of direct drive of the contact wheel there is no loss of power or speed of the abrasive belt. The speed provides quick, cool stock removal on all applications such as grinding, polishing and deburring. The idler arm incorporates belt tracking and tensioning mechanisms and can be rotated 360° around the spindle to provide operation in any position. The standard abrasive belt size is 2 in. wide by 48 in. long.



LOOKIN' FOR QUALITY?
LOOKIN' FOR SERVICE?
STOP LOOKIN'
JUST CALL . . .
BETTER FINISHES & COATINGS, INC.
268 Doremus Avenue, Newark 5, New Jersey
2014 East 15th Street, Los Angeles 21, California
BFC
Extra High Purity
CHROMIC ACID
FLAKE
BETTER FINISHES AND COATINGS, INC., NEWARK 5, N. J.
Regular Flake—Thin Flake—Ground—whatever your Chromic Acid needs, we can supply them—promptly. Fast shipments from plant and nearby distributor stocks. All extra high quality 99.75+% pure.

The

JUNE ISSUE

will be our

Convention Issue

▼

Advertising forms will close early

▼

for Information write or phone Advertising Manager

PLATING

445 Broad Street
Newark 2, N. J.

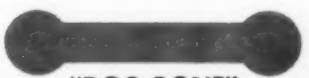
Tel.: HUmboldt 2-3400

SHAPED, EXTRUDED ANODES

3 STANDARD SHAPES

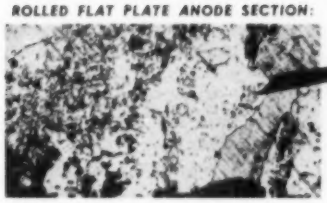
"RECTANGULAR"

"TEAR DROP"



"DOG BONE"

ROLLED FLAT PLATE ANODE SECTION:



This Photomicrograph shows highly irregular, uncontrolled grain size—a major cause of shedding and resultant rough electrodeposits.

Note small, fully controlled regularity of grain size that promotes uniform corrosion, smoothest electrodeposits, less rejects.

APW EXTRUDED ANODE SECTION:

THE GREATEST ANODE DEVELOPMENT IN YEARS

APW Shaped, Extruded Anodes were developed to extend the useful life of our anodes . . . to assure uniform and consistently smooth electrodeposits . . . to minimize shedding. They accomplish these objectives for our customers day after day—and in addition, *they have helped to lower plating costs!*

The anodes are scientifically shaped to retain 80% of original surface area *after 85% by weight has been plated off!* You get longer anode life, minimized polarization and less silver scrap to be refined.

The APW Extrusion Process* assures small, uniform grain size controlled between definite, ideal limits. Corrosion is smooth, shedding is virtually eliminated, rejects are a comparative rarity.

Be certain the silver you buy in anodes is used most efficiently and economically. Our service department will be glad to develop special anode shapes to meet your particular plating bath conditions. Call or write for a representative, we'll be glad to assist with your anode problems. ★ ★ ★ ★ ★ ★

*Pat. Pending

THE AMERICAN PLATINUM WORKS

231 NEW JERSEY RAILROAD AVENUE • NEWARK 5, NEW JERSEY

APW

ENGELHARD INDUSTRIES

PERSONALS

Harshaw

Smith

William A. Harshaw II, grandson of the founder, and son of Chairman **W. J. Harshaw** has been elected vice president-research, and **Leslie N. Smith** was named vice president-scientific division at Harshaw Chemical Co.

Mr. Harshaw, who obtained his BS degree from Western Reserve University, started with the company in 1944 in research and sales. He became sales manager of the development department in 1951 when he also was named assistant secretary. In 1953 he was promoted to manager of the Philadelphia branch. He now will make Cleveland his headquarters.

Mr. Smith who joined the Harshaw organization in 1919 has handled a varied group of assignments in the laboratory, in cost accounting and as manager of the General Sales Office. Member of the Electrochemical Society, he was for twenty years active in sales and development in the field of electroplating. During this time, he was prominent in the pioneering of today's advanced types of nickel anodes and bright nickel plating process. For fifteen years of this period, he was sales manager for the company's electroplating products and processes. In 1951 was appointed general manager, Scientific Division and will continue in charge. He attended Penn College during his business career.

O'Brien

Sakavich

A. E. Sakavich has been appointed in charge of sales development service for Kelite Corp.

He will be part of Kelite's marketing department in Berkeley Heights, N. J., where his duties will include advertising and sales promotion.

John E. O'Brien has been appointed district sales manager of the Philadelphia Sales District.

With Kelite, he will have responsibility for all sales in Pennsylvania, Maryland, Delaware, Virginia, West Virginia, and southern New Jersey.

R. L. Greene, assistant sales manager, has been appointed to Special Products Sales to supervise all activities in connection with aluminum treatments marketed by Parker Rust Proof Co. He will work closely with Parker's field men in calling on accounts in this rapidly expanding field. Mr. Greene has been with Parker for 17 years and has had over twenty-four years of experience in selling and servicing metal treatment coatings and installations.

Also announced were the appointments of **R. I. Peterson,** general service manager, to the post of Central Region Manager and **C. F. Rasmussen,** assistant service manager, to the post of Assistant Central Region Manager. Mr. Peterson has been with Parker 15 years and served in the Research and Sales-Service Departments prior to his appointment as general service manager. Mr. Rasmussen has been with Parker over 10 years.

Raymond B. Anthony has been appointed manager of the newly formed Special Chemicals section in the sales department of Solvay Process Div., Allied Chemical & Dye Corp. **Fred P. Boehm,** who has been located at Solvay's central sales office, New York City, moves to the company's Pittsburgh, Pa., sales branch.

Under the new set-up **Solon D. Fisher** will serve as technical assistant to the manager of the newly formed section. **Joseph L. Hake** has also been named assistant to Mr. Anthony, while **George R. Barclay** becomes assistant to the manager of Solvay's Organic Chemicals section.

A graduate of Brown University, Mr. Anthony joined Solvay in 1928 as a salesman. Assigned to the Boston branch, he worked in that territory until his transfer to New York in 1953 as assistant manager of the Special Alkalies Section. The following year Mr. Anthony advanced to the position of manager.

Mr. Boehm received his BS degree in chemistry from the Texas College of Mines. He became a member of Solvay's Technical Service department at Syracuse in 1940. Mr. Boehm was assigned to sales activities at the company's New York office in 1953.

Mr. Hake was first employed by Solvay in 1941. After serving in the Navy during World War II, he returned to Solvay, assigned to the Special Alkalies section. Since 1949, Mr. Hake has been a salesman at the Detroit branch.

Mr. Barclay holds a BA degree in Science from the University of Toronto. With Solvay since 1950, he held the position of technical service representative until moving to Detroit in 1951 as a salesman. Prior to his present appointment he had been assistant to the manager of the Special Alkalies section in New York City.

Arthur J. Buckley has been promoted to general sales manager from his former position of sales manager at Pangborn Corp., Hagerstown, Md. Mr. Buckley joined Pangborn in 1952 as assistant sales manager and was elevated to sales manager in 1955.

Joseph D. Allen Jr., has been appointed chief technical sales engineer for the Eastern District of Federated Metals Division, American Smelting and Refining Co.

Mr. Allen is widely experienced in all phases of foundry practice and procedure, and has a thorough background in the field of white metal alloys. In his new capacity, he will devote much of his time and effort toward the development of better metallurgical and casting practices in the foundry, die casting and white metal industries.

Donald H. Bissell has been elected president of Chromium Corporation of America, N. Y. He formerly was vice president and secretary and has been succeeded in this position by **Charles H. Belvin.**

Mr. Bissell has extensive experience in the field of job electroplating having been connected, in an official capacity, with the Chromium Corporation of America for more than 30 years.

John A. Robertshaw Jr., has been elected a vice president of Robertshaw-Fulton Controls Co.

Mr. Robertshaw, a grandson of one of the founders, has been associated with Robertshaw since his school days, working in plant and office jobs during off hours and vacations. He has been in charge of foreign operations since 1952, and was made an assistant vice president in 1954.

Mr. Robertshaw attended Greensburg, Pennsylvania, grade schools, the Lawrenceville School in New Jersey, and studied engineering at Yale. He was graduated with a BS degree in industrial administration in 1949, having interrupted his education for wartime service in radio and electronics with the Navy.

L. J. Polite Jr. has been promoted to product sales manager of the Chlorinated Products Division of Diamond Alkali Co.

Sales manager for certain major Diamond organic chemicals during the past year, Polite will now hold overall sales responsibility for the complete, diversified line of chlorinated products manufactured by the company at plants in Painesville, Ohio; Deer Park and Greens Bayou, Texas; Newark, New Jersey, and Belle, West Virginia. These include chlorinated

solvents, organic intermediates, acids, Chlorowax (a chlorinated paraffin), and agricultural chemicals.

A veteran of 15 years' service with Diamond, Polite joined the Company as a sales representative in 1942 following graduation from Williams College, Williamstown, Massachusetts, where he earned a BA degree.

Mervyn T. Walsh has been appointed to manage Diamond Alkali's muriatic acid sales.

In addition to his new responsibilities, Walsh will continue to manage sales of Chlorowax, a chlorinated paraffin available in both liquid and resinous forms and which has wide industrial application.

Charles W. Wheeler has been appointed to manage solvent sales for Diamond Alkali.

At his new post, Wheeler will be responsible for sales of Diamond solvents produced at Painesville (Ohio); Belle, West Virginia, and Houston, Texas. These chemicals include perchlorethylene, carbon tetrachloride, ethylene dichloride, fire extinguisher fluid, chloroform, methyl chloride and methylene chloride.

William J. Esselstyn has been promoted to manage organic intermediates and new product sales for Diamond Alkali.

At his newly-created position, Esselstyn will hold sales responsibility for Diamond chlorinated intermediates and related organic chemicals. He will also coordinate divisional technical service activities covering Diamond solvents and organic intermediates, and supervise bulk-terminal operations on these products.

Calise

Vincent J. Calise has been appointed general sales manager for Graver Water Conditioning Co.

Mr. Calise has spent more than 17 years dealing with all aspects of business in these fields. He is the holder of both Chemical Engineering and Mechanical Engineering degrees and is a widely known speaker and authority on water and waste treatment. He is a licensed Professional Engineer in the State of New York.

He has pioneered in many developments and applications in the water treatment field. These developments include the use of demineralization (an ion exchange process) for power plant and process water treatment, hot process treatment, deaerating heater designs and use in the power plant cycle, clarification and softening of hard and turbid water supplies and the application of ion exchange to plating and waste problems.

Cherry

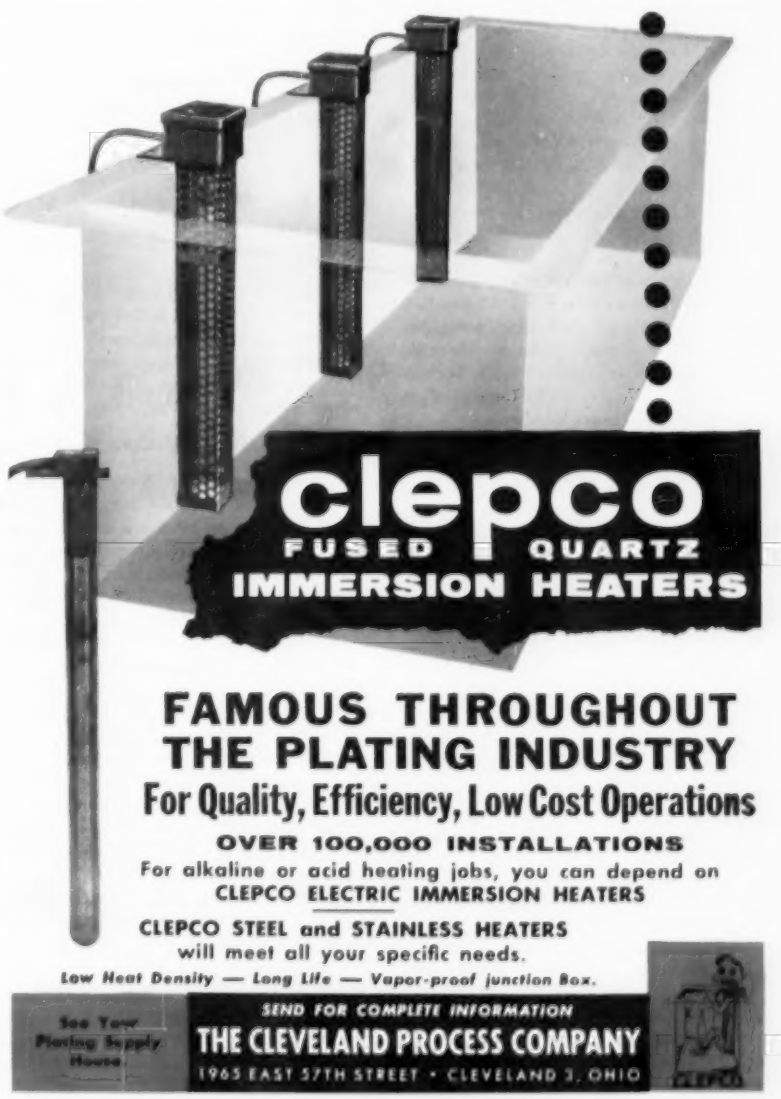
The Board of Directors of the George L. Nankervis Company has announced the election of **Harold M. Cherry** as president, following the recent death of George L. Nankervis, founder and former president of the company.

Mr. Cherry has been associated with the corporation since 1944 and was senior vice president. He is a graduate engineer from the University of Michigan and a resident of Huntington Woods. He is a member of the American Ordnance Association, The Engineering Society of Detroit, and the American Electroplaters' Society.

The Board of Directors also appointed **Claude E. Cox, Henry W. Grikscheit, Vernon G. Converse** and **Stanley R. Andersen** to the Executive Committee. The Nankervis Company designs and builds precision automotive and aircraft testing instruments and equipment. It also engineers and installs electroplating and metal finishing systems.

Henry B. Koehler has been appointed electrical sales engineer for Hanson-Van Winkle-Munning Co.

In this capacity Mr. Koehler will concentrate on the engineering and sale of motor generator equipment for the metal-finishing industry.


clepco
FUSED QUARTZ
IMMERSION HEATERS
FAMOUS THROUGHOUT
THE PLATING INDUSTRY
For Quality, Efficiency, Low Cost Operations
OVER 100,000 INSTALLATIONS
For alkaline or acid heating jobs, you can depend on
CLEPCO ELECTRIC IMMERSION HEATERS
CLEPCO STEEL and STAINLESS HEATERS
will meet all your specific needs.
Low Heat Density — Long Life — Vapor-proof junction Box.
See Your Plating Supply House
SEND FOR COMPLETE INFORMATION
THE CLEVELAND PROCESS COMPANY
1965 EAST 57TH STREET • CLEVELAND 3, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 418.

Use the Reader Service Card to obtain literature

L—413. Brushes and Brushing Machines—The Osborn Manufacturing Co., announces the availability of a new 100-page two-color illustrated catalog "Brushes for Industry."

The 8½ x 11 plastic bound catalog contains detailed information on how to select and use power brushes, Brushamatic machines, power brushes, paint and varnish brushes and maintenance brushes.

L—414. Plastic Pipe, Fittings and Valves—A new engineering catalog with technical and descriptive data about its plastic pipe, plastic fittings and plastic valves is now being made available by Vanton Pump & Equipment Corp., Division of Cooper Alloy Corp.

The eight-page catalog includes comprehensive tables detailing both the physical properties and the chemical resistance of the three basic plastic compounds Vanton uses for its products—PVC (Unplasticized, unmodified polyvinyl chloride), styrene-copolymer and Buna N (Acrylonitrile-Butadiene).

L—415. Steel Equipment Manual—Equipto announces the new 1957 free Reference Manual of Steel Equipment No. 485. This 48-page book covers steel shelving, drawers, lockers, work benches and tables, and other storage, store, office, warehouse, and shop equipment.

L—416. Soak and Dry Salt Cleaners—An alkaline soak cleaner that combines deep-recess penetration, rapid wetting, efficient softening of grease deposits and complete emulsification of oil soils is fully described in Technical Data Sheet No. 40, a two-page usage and instruction sheet prepared by Mac Dermid Incorporated. Named Metex T-103, this free-flowing, detergent-type soak cleaner has been especially prepared for removing oil and grease from steel, copper and brass.

Preparing aluminum for spot-welding, phosphating, anodizing and painting with a dry anhydrous salt, Deoxidex, used in solution in water is fully described in Mac Dermid's three-page Technical Data Sheet No. 25.

L—417. Protective Maintenance Brochure—A four-page, two-color, photographically-illustrated brochure on the application of protective coatings and linings, citing an actual case history explaining how metallizing saved a semi-chemical pulp digester from reduced operating status, is available from Protective Coatings Div., Metalweld, Inc., Pa.

The brochure also lists coatings and linings applied by Metalweld. Among these are: sheet linings; sprayed metal coatings; synthetic resin and combination coatings. It also gives data on sand and grit blasting as well as fabrication and major repairs of process equipment.

L—418. Matic and Tufmatic Brushes—The subject of the most recent publication of The Osborn Mfg. Co., Cleveland, Ohio, highlights two power brushes:

Osborn Matic Brush—a vital production brush that maintains precise brushing action under rigorous continuous use and Osborn Tufmatic Brush—designed to do a stronger brushing action than the "Matic" for removing burrs and scale which are difficult for other brushes to do effectively.

L—419. Industrial Equipment—A 24-page, illustrated handbook containing detailed specifications and complete descriptive data on a full line of office and factory equipment has been published by General Industrial Co.

Featured in this handbook are such items as shelf trucks, lockers, small parts cabinets, hand dryers, fireproof blueprint cabinets and glass door display cases. This handbook will prove of value to the executive concerned with office or factory equipment.

L—420. Review of Zinc Industry—"A Review of the Zinc Industry in the United States in 1956," a new 15-page booklet has been published by the American Zinc Institute, Inc., N. Y.

The Institute's annual review summarizes the production and consumption picture of the zinc industry as of December 31, 1956. Comprehensive tables cover such topics as mine production, imports of slab and ore, slab zinc consumption, zinc uses by grades, production of slab zinc according to grade, and tariff rates.

The growth of zinc used for galvanizing and die casting is discussed, with emphasis on the mounting consumption in continuous galvanizing and the use of zinc die castings by the automotive industry. Present trends in plant expansion are noted, and producers' flexibility of operations commented upon.

L—421. Tubing Bulletin—"Teflon" thin-walled tubing is the subject of a new bulletin issued by Haveg Industries, Inc., Wilmington, Del. "Teflon" is a DuPont tradename for tetrafluoroethylene.

This 2-page bulletin, T-200, stresses "Teflon's" range of electrical properties, for thin-walled tubing finds wide applications in electronics as sheathing for cables, slip-on and sleeving insulation in motors, generators, transformers. It is further used as instrument wiring for automotive, aviation, communications, electronics, locomotive, marine equipment and missiles. Because of "Teflon's" almost complete resistance to chemical attack, it also finds many uses in chemical and petroleum processing.

L—422. Paint Stripping Booklet—A booklet, explaining the latest methods and applications for hot and cold paint stripping as used in removing enamels, epons, japans, lacquers and varnishes plus organic finishes, is available from the DuBois Co., Inc. This booklet is being offered in conjunction with the announcement of a Paint Stripping Clinic opened by DuBois now available for use by industrial plant superintendents and foremen.

The booklet, "Practical Shop Guide to Modern Paint Stripping Methods and Materials," describes applications now being used in hot and cold stripping, catalysts which accelerate and improve stripping, safety in use on metals and personnel, tank and brush-on type compounds.

DuBois Paint Stripping Clinic offers its laboratory facilities for special problems and tasks. Plant superintendents and foreman send test panels or work samplers to the DuBois laboratories for quick testing and a report of the findings is then issued by chemists.

L—423. Spray-Dip Unit—Its newly introduced Mark III, a dual-purpose thermoplastic spray and fluidizing unit, is pictured and described in a new catalog sheet, released by the American Agile Corp., Ohio.

The unit, the first of its kind, is easily rolled to the point of use for fast, economical and flexible operations of both spray and fluidized (dip) coating of metallic targets.

For spray coating, the Mark III utilizes a finely divided modified polyethylene powder to provide a coating up to 2/16 in. thick. For fluidizing, in addition to polyethylene, other finely divided thermoplastic resins may be used.

L—424. Indicating Pneumatic Controllers—A new catalog describes Brown Small-Case Indicating Pneumatic Controllers for temperature and pressure. There are a number of temperature ranges between 0 to 1000 F, and pressure ranges from 0 to 1000. Length of eccentric scale in each instrument is 4½ inches, with black markings on white background. Measuring accuracy is ± 1 per cent of full scale.

L—425. Free Conversion Factors Wall Chart—A reference table for engineers and other executives in wall chart form has been published by Precision Equipment Co. This Conversion Chart is useful for engineers, shopmen and other executives.

Included are common conversions such as inches to centimeters or watts to hp as well as many conversions that are difficult to locate in reference manuals. (Some such examples are atmospheres to Kgs/sq cm, cm/sec to miles/hr, cu ft to liters, microns to meters, quintal to lbs).

L—426. Literature on Cost Reduction Plan—Reduction of industrial glove costs is the purpose of two pieces of literature published by Jomac Inc., Philadelphia, Pa., manufacturers of gloves, sleeves and hand pads made from loop pile fabric.

A four-page folder, "Jomac Cost-Reduction Analysis of Glove Use," contains a form which, when filled in, permits Jomac to recommend the glove best fitted for the job.

A 12-page booklet, "Evidence from the Jomac Cost-Reduction Plan," shows how the analysts of glove use has cut costs in typical industries.

L—427. Cut Production Costs—Ways to use low-cost optical instruments to simplify and speed manufacturing and inspection operations are outlined in a booklet published by the Bausch & Lomb Optical Co., Rochester, N. Y.

The booklet, "Industrial Optical Aids," contains up-to-date information on a wide assortment of inexpensive precision optical instruments and suggests ways to use them to gain faster, easier, lower-cost production. Items discussed include magnifiers, microscopes, wide field tubes, macroscopes and comparators.

Dimension drawings of all instruments included in the booklet are available on request.

L—428. Ventilating and Exhaust Systems—A comprehensive brochure on corrosion-proof ventilating and exhaust systems, has just been released by the American Agile Corp.

The 12-page literature covers such items as thermoplastic corrosion-proof centrifugal fans, ducting and fittings, and hoods.

The brochure is augmented with more than three dozen illustrations. All data is arranged in chart form for ease of reference, and all information is based on a full year of engineering design, construction and conclusive testing.

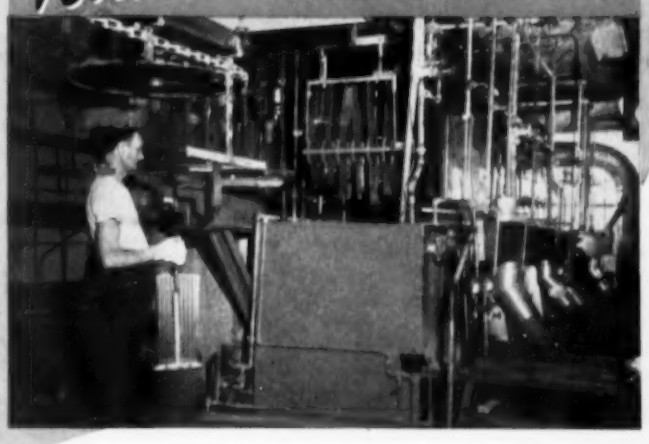
L—429. Water Treatment—A new technical article on automation of water treatment plants is being made available by Graver Water Conditioning Co.

Automation is finding wide application in the boiler feedwater and process water

Get All these Advantages in CHROME PLATING and ANODIZING

with

Nalcite® ION EXCHANGERS



- REDUCE WASTE DISPOSAL
- RECOVER RINSE WATER
- INCREASE PRODUCTION
- IMPROVE QUALITY
- RECOVER VALUABLE METALS
- LOWER CURRENT DEMAND
- REDUCE REJECTS

You can solve major waste disposal or water conservation problems ... and get *five extra advantages* ...with the Nalcite Ion Exchange process in your plating or anodizing plant.

Check these plus benefits in the list at left. They are important contributions to efficiency and economy in plating processes. We invite you to write, today, for full information on Nalcite Ion Exchangers.

NATIONAL ALUMINATE CORPORATION

6301 West 66th Place • Chicago 38, Illinois

In Canada: Alchem Limited, Burlington, Ontario

Nalco®

PRODUCTS . . . Serving Industry through Practical Applied Science

treatment fields. With the percentage of automatic plants being installed growing enormously each year, this subject is of interest to all persons coming in contact with the water treatment field.

Technical Reprint T-148 discusses this important development in detail. Several specific case histories are presented pointing out the problems involved and the methods of solution. Flow diagrams of these plants are shown to allow the reader to understand the problem and solution.

L—430. Industrial Lighting—A new industrial lighting booklet, "Prescribed Lighting Protects the Eyes of Industry," has been made available by Sylvania Electric Products Inc.

The 28-page booklet features sections on safety and visibility factors, standards for use in prescribing plant lighting, uses of fluorescent, incandescent and mercury vapor lamps; lighting of other areas, maintenance, and condensed catalog data on fixtures. The booklet outlines the four related visibility factors of size, contrast, time and brightness, and lists 10 advantages to be gained from improved lighting.

L—431. Alkalies and Chemicals—A new book containing detailed information on the entire line of Solvay alkalies and chemicals has been announced by the Solvay Process Division, Allied Chemical & Dye Corp.

This Products Book includes data on the uses, markets, physical and chemical properties, packaging and handling and storage of the Solvay line. Also included is a listing which groups the products by consuming industries or manufacturing processes.

L—432. Epoxy Resin Systems Chart—A summary chart, outlining the physical and electrical properties of epoxy resin systems has been published by Permacel Tape Corp.

The chart lists 25 different systems handled by Permacel and the basic properties of each. Information on the chart includes such things as the average pot life of the resin in a 100 gram mass at 80 F, viscosity in centipoises at minus 80 F before and after addition of hardener, physical properties of cured samples at 80 to 85 F, volume resistivity, dielectric constant and dissipation factor.

L—433. Abrasive Wheel Data—A completely new and comprehensive grinding wheel Net Price and Data Book has been announced by the abrasive wheel dept., Manhattan Rubber Division of Raybestos-Manhattan, Inc. It lists rubber and resinoid bonded grinding wheels, and combines them in convenient form. All multipliers are eliminated and the actual consumer net price is shown for all quantities. The scheduled additions for special shapes are adjacent to straight wheel net prices, thus eliminating unnecessary cross reference. For added convenience, separate pages are provided for special items such as cut-off, depressed-center Moldises, centerless grinding and regulating wheels.

L—434. Polyethylene Floats—New Agile Mini-Vaps, expanded polyethylene floats which cut evaporation loss of open liquids, are illustrated and described in a new catalog sheet, just issued by the American Agile Corp.

The specifically engineered surface contours of these floats provide for extensive interlocking and clustering at the surface of volatile solutions, retarding evaporation losses. During dipping, they part to admit the object being dipped; when the object is removed, they immediately return to a covering position.

L—435. Aluminum Chart—Users of light metals can now obtain a chart that converts old aluminum type designations to the new designations now in use. The conversion chart published by All-State Welding Alloys Co., Inc. is on a single punched sheet. So much of the service

FOR QUALITY CONTROL
THE MOST COMPACT PLANT
AT LOWEST INSTALLED COST

DANIELS CUSTOM PACKAGED PLATERS

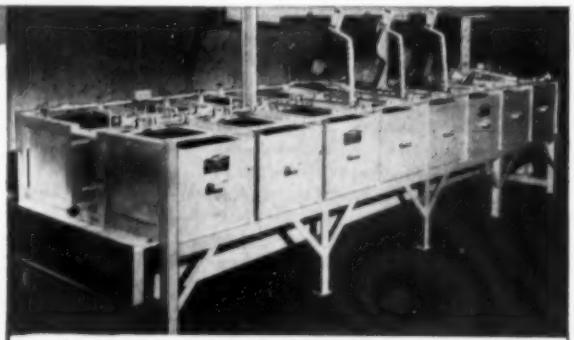
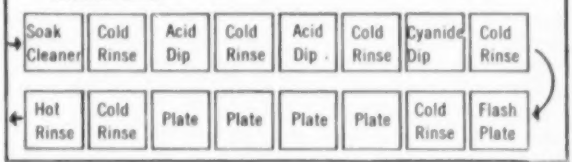


Photo shows typical Daniels Packaged Plater and plating cycle. Any sequence of operations is adaptable to their versatile units.



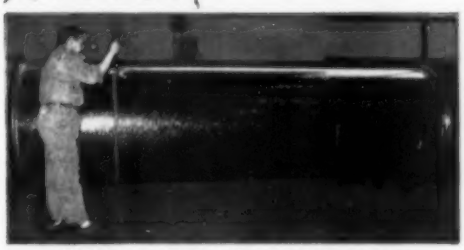
Whenever your work demands a high degree of quality and uniformity — that's when you should get all the facts on Daniels Custom Packaged Platers. Each of these completely self-contained plating plants is designed to meet your specific production needs. Daniels Custom Packed Platers have found wide acceptance in the electronics and jewelry industries, where precise quality control is a major objective. Also, you'll make these three important savings: Compactness (small floor area), low installed cost, speed of operation without sacrificing uniformity.

FREE: Write today on your letterhead for illustrated booklet describing both Daniels standard plating barrels and Custom Packaged Platers.

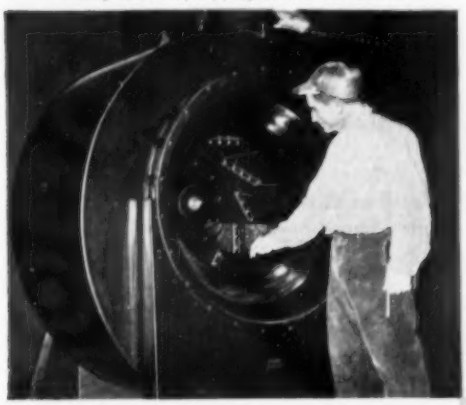
41 Years of Dependable Service
DANIELS PLATING BARREL & SUPPLY CO.
129 Oliver Street, Newark 5, N. J.
MArket 3-7450

Our years of experience give you . . .

*BALANCED QUALITY** in MICCROSOL



ABOVE: Large duct section coated by spraying with Miccrosol Spray S-2003. BELOW: Fan housing coated by dipping in Miccrosol E-1003.



Developed originally as a coating for plating racks, Miccrosol E-1003 has all the desirable characteristics which make it an ideal coating for many other applications.

The chemical resistance of Miccrosol is unequalled in its field. Its toughness, abrasion resistance, resilience, and flexibility are unsurpassed. It's easy to apply in either a *dip* or *spray* formula. When necessary, it's easy to repair.

Year after year we build this quality into Miccrosol, improving it whenever possible and practicing every economy in its manufacture that does not compromise the excellence of the product.

This BALANCED QUALITY enables you to use Miccrosol *profitably* while assuring your customers of coating jobs that will prove superior in their performance.

**Outstanding performance and value*

For tanks, ducts, and other equipment

Developed and manufactured by experienced platers and coaters

MICHIGAN CHROME *and Chemical Company*

8615 GRINNELL AVENUE • DETROIT 13, MICHIGAN

literature current among aluminum users has not been reissued since the new type designations were adopted as to make this chart very helpful.

Included on the same sheet with the conversion chart are six other charts concerning aluminum. They are especially designed to aid in the wise selection of alloys and fluxes to weld, braze and solder aluminum.

L—436. Germanium Rectifiers—Bulletin GL-1 describing germanium Golden Line rectifiers has been published by Rapid Electric Co.

The new brochure contains illustrations and specifications of the Golden Line models 750, 1500, 2500 amp, 2–12 v.

Some of the features described are less than 5 per cent ripple, unique switching arrangement of output voltage, and Ferro-magnetic overload protection.

L—437. Polish for Steel—A chemical polish for steel, designed to produce a bright finish on steel articles by simple immersion, is fully described in Technical Data Sheet No. 32, a two-page usage and instruction sheet prepared by Mac Dermid Incorporated. MirroFe, the new polish, produces after a one-minute dip, a brightness equal to 30 minutes of bright nickel electroplate on a steel surface of medium finish. It is effective on low carbon steel, hardened high carbon steels and low alloy steel.

L—438. Germanium Plating Rectifier—Bulletin GED 2934 describes a new air-cooled germanium plating rectifier featuring unique cooling system design, fingertip remote control and automatic voltage stabilization in ratings from 6–24 and 750–12,000 amp manufactured by General Electric Co.

L—439. Dust Control—"Dust Control for Industry" is the title of a new 16-page illustrated reference bulletin just released by the Pangborn Corp., for plant engineers, managers and maintenance engineers.

ANODIZING RACKS

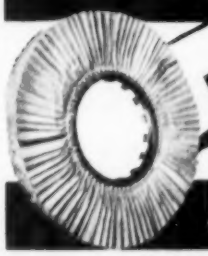
for **fast racking and unloading small parts**

Handles variety of work. Reduces handling, eliminating wires, springs, etc. *Economical—time saving.* Replaceable units can be assembled in any spacing arrangement desirable. Made in *aluminum* and *titanium.* Write for circular.

ALL BRITE CHEMICAL COMPANY
P. O. Box 136A, Watertown, Conn.
Telephone Crestwood 4-8811

USE READER SERVICE CARD; INDICATE A 412.

INVESTIGATE THESE
7 keys TO GREATER BUFFING OUTPUT



CUT COSTS!
CUT FINISHING TIME!
BOOST YOUR PROFITS!
See pages 418, 434, 438

AMERICAN BUFF COMPANY
2414 South LaSalle Street Chicago 16, Illinois

USE READER SERVICE CARD; INDICATE A 422.

Rhodium
ELECTROPLATING SOLUTIONS

Consult our staff, without obligation, about your specific plating problems.

SINCE 1901

Technological knowledge acquired through many years of experience, plus special processes and equipment, assure the high quality of our Rhodium Plating Solutions.

Recommended for contact surfaces of switches, waveguide parts and other electrical applications; can be applied in extremely heavy deposits, where required, up to 100 milligrams per square inch.

Rhodium plating provides the advantages of whiteness, lustre and corrosion resistance of a precious metal.

SIGMUND COHN MFG. CO., INC.
121 SOUTH COLUMBUS AVENUE • MOUNT VERNON, NEW YORK

Specialists in the Unusual

Simple bronze plating process gives gold-like finish

- ***M&T copper-tin process deposits extraordinary, golden-glow decorative plate . . .***
- ***Also cuts need for nickel as undercoat***

BRONZE plating has proved itself a practical finish in large and small installations. The copper-tin process developed by Metal & Thermit eliminates usual difficulties and disadvantages in alloy plating. It is as easy to operate and control as normal processes depositing a single metal.

Equally important, this bronze can be deposited with brilliant 24K gold color by using a trouble-free brightener. Protected with a clear organic coating, it provides a high quality decorative finish with unusual appeal and long life. Overall cost of this bronze rivals that of copper and is less than that of a brass plate.

M&T Bronze gets the trophies. Golden-glow finish for die cast trophy cups wins over copper-nickel-gold formerly used by leading producer.

VALUABLE UNDERCOAT

As an undercoat, M&T Bronze has these qualifications: Good corrosion resistance; hardness better than copper and virtually equal to nickel; more ductility than nickel.

Undercoat-bronze can be plated semi-bright or matte. Both buff more readily than copper and with less chance of cut-through on edges.

OPERATIONAL ADVANTAGES

M&T Bronze offers better than twice the speed of fast copper plating solutions. There are numerous installations working at normal current densities of 60-75 amps per sq. ft. Densities of 100 amperes deposit over one-tenth mil a minute smoothly.

Golden-glow bronze delivers uniform color on intricate decorative work. So outstanding is its throwing power, it is being used to replace copper on complex automobile parts. It uses single anode circuits, and copper anodes which corrode uniformly. The tin is supplied by potassium stannate additions, assuring simple, economical control of the process.

For an unusual finish, both in appearance and protective function, the golden-glow M&T Bronze Process offers interesting possibilities to metal finishers and designers. Send for data.

What's news in tin anodes

Two types of M&T Anodes are available for tin plating processes.

M&T "High Speed" Tin Anodes, developed for stannate baths, have wider effective current density range than ordinary anodes. Taking higher currents without becoming passive, they speed up plating. They form *darker*, more recognizable working film. They pass more current for a given voltage.

The other type, M&T Pure Tin Anodes, are designed for work both in acid baths and alkaline baths. They're cast from highest purity tin. Send for data on both types.

New economy in chromate finishing

Several newly developed Unichrome Dip Compounds work at extreme dilutions. They offer chromate solutions with still lower make-up and operating costs than previously delivered by economical Unichrome Dips. These new Dips make it practical to preserve shelf life and appearance of galvanized, zinc plated or die cast items, even those having low unit price or narrow margin of profit.

Unichrome is a trademark of Metal & Thermit Corp.

METAL & THERMIT
CORPORATION
General Offices: Rahway, New Jersey
Pittsburgh • Atlanta • Detroit
East Chicago • Los Angeles
In Canada: Metal & Thermit—United Chromium of Canada, Limited, Rexdale, Ont.

BOOKS OF PROVEN VALUE

Handbook of Engineering Materials
Edited by D. F. Miner and J. B. Seastone
Nonmembers $17.50 Members $15.00

Temperature: Its Measurement and Control in Science and Industry
Edited by H. C. Wolfe
Nonmembers $12.00 Members $10.20

Principles of Industrial Waste Treatment
by F. Gurnham
Nonmembers $9.50 Members $8.10

Water Supply and Waste-Water Disposal
by G. M. Fair and J. C. Geyer
Nonmembers $15.00 Members $13.00

Industrial Wastes, Their Treatment and Disposal
Edited by W. Rudolfs
Nonmembers $9.50 Members $8.10

Titanium in Iron and Steel
by G. F. Comstock
Nonmembers $6.00 Members $5.10

Introduction to Atomic and Nuclear Ph
by H. Semat
Nonmembers $6.50 Mem

Elements of Statistical Me
by Dirk ter Haar
Nonmembers $8.50 Mem

Adhesion and Adhesive Fundamentals and Pra
Nonmembers $9.75 Mem

Deterioration of Materi Causes and Preventive Tec
Edited by G. A. Greathouse and C
Nonmembers $12.00 Mem

Analysis of Electroplat and Related Solution
by K. R. Langford
Nonmembers $8.00 Mem

Electroanalytical Chem
by J. J. Lingane
Nonmembers $8.50 Mem

▼ *USE SELF-ADDRESSED Return Card to Order Books. Remittance must accompany order.*

First Class Permit
No. 4032,
Sec. 34.9,
P. L. & R.
Newark, N. J.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

AMERICAN ELECTROPLATERS' SOCIETY
445 BROAD STREET
NEWARK 2, NEW JERSEY
Att. Book Dept.

Postage
Will be Paid
by
Addressee

READER SERVICE CARD

April 1957. Do not use after June 15, 1957

Please send me information on the following—

Ads: A..... A..... A.....
A..... A..... A.....
Tr. Lit.: L..... L..... L.....
E & S E..... E..... E.....

E

to
Physics

Members $5.85

Mechanics
AR
Members $7.65

esives—
Practice
Members $8.30

terials—
Techniques
ND C. J. WESSEL
Members $10.20

plating
tions
ORD
Members $6.80

hemistry
IE
Members $7.50

rder.

CARD

Name.....
Company.....
Company Address.....
City.....
Position or Title.....
Zone.....
State.....

1956 TECHNICAL PROCEEDINGS AVAILABLE FOR ORDER

Demand, internationally, for copies of the recently published 1956 Edition of the AES's book, TECHNICAL PROCEEDINGS, is gaining momentum. Hence, the Society's limited remaining supply is diminishing.

Containing each of the 42 papers delivered before the AES's last Annual Convention, together with their charts, diagrams, graphs, tables and other illustrations, and with the verbatim discussion that followed their delivery, TECHNICAL PROCEEDINGS broadly enriches technical and scientific knowledge in the field of electroplating, metal finishing and allied arts. It totals 308 pages compared with the 1955 Edition's 255 pages.

Orders for copies will be accepted and serviced by the American Electroplaters' Society on strictly a first-come, first-served basis so long as its limited supply lasts.

The domestic cost of the book is $12.50 per copy including postage. To those ordering it from outside the United States' continental limits, the charge is $15 per copy including postage cost. All orders must be accompanied by payment in full to obviate unnecessary bookkeeping expense.

Address orders to:

AMERICAN ELECTROPLATERS' SOCIETY
INC.
445 Broad Street, Newark 2, N. J.

look at these advantages of

IRIDITE® FINISHES

for

CORROSION-RESISTANCE, PAINT BASE on ALUMINUM and MAGNESIUM

Aircraft and Missile Parts

Automobile Hardware

Outdoor Furniture

Communications Equipment

Marine Equipment

EASE OF USE—Iridite is a simple chromate conversion treatment. Fast, easy, economical. You just dip, brush or spray it on the part at room temperature. No special equipment. No specially trained personnel.

OUTSTANDING PERFORMANCE—Forms a film that is an integral part of the metal itself. Can't flake, chip or peel. Takes paint firmly on initial application, and the bond lasts. Even protects areas scratched in use.

LOWEST COST—You have only minimum equipment cost, no special racks, high speed operation, lower overall handling costs.

CHOICE OF APPEARANCE—Clear coatings that retain metallic lustre to dark, maximum protection coatings. A variety of colors is available by dyeing.

IRIDITE # 14 and # 14-2 (Al-Coat) for ALUMINUM

Two specially formulated finishes that give you maximum latitude in aluminum treatment. Both provide excellent corrosion protection and paint base. Iridite #14-2 is an improved product that allows greater flexibility in operation and coating thickness and produces the optimum in corrosion protection.
Either coating provides corrosion resistance superior even to complicated electrolytic treatments in a fraction of the time. These coatings also offer many other valuable characteristics: they have low electrical resistance, they aid in arc-welding, provide a good base for bonding compounds, have no effect on the dimensional stability of close-tolerance parts. Final appearances ranging from clear through yellow iridescence to full brown can be obtained. By dyeing, you can produce red, green, blue, orange or yellow finishes.

IRIDITE # 15 for MAGNESIUM

Produces a protective, paint base film with corrosion resistance at least equal to that obtained from long, high-temperature dichromate treatments in a fraction of the time and at room temperature. The appearance of the coating can be varied from light brown to dark brown and black.

APPROVED UNDER GOVERNMENT AND INDUSTRIAL SPECIFICATIONS

SEE FOR YOURSELF WHAT IRIDITE CAN DO . . . SEND SAMPLE PARTS FOR FREE PROCESSING. Look at the results, test the protection, evaluate the savings. Also write for handy Reference File of the most complete data published on chromate conversion coatings. Or, for immediate information, call your Allied Field Engineer. He's listed under "Plating Supplies" in your classified phone book.

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals.
West Coast Licensee—L. H. Butcher Co.

PRICES

Anod

COPPER
Cast elliptical, 18 inches
lots. . . . . .
Electrodeposited. . . . . .
BRASS, 80-20, ball anodes,
ZINC, ball anodes, 2000 lb l
(for elliptical add 2¢ per
NICKEL, 99 pct plus, rolled
(rolled depolarized add 3
CADMIUM. . . . . .
TIN, ball anodes and elliptic

(Cents per lb, freight a

Primary

GOLD, U. S. Treas., per oz.
INDIUM, 99.9 per cent, per
LEAD, New York, cents per
PALLADIUM, per troy oz.
PLATINUM, per troy oz. .
RHODIUM, per oz. . . . . .
SILVER, New York, cents

These prices, while de
purchase, FOB and oth

Postage Will be Paid by Addressee

First Class Permit No. 4032, Sec. 34.9, P. L. & R. Newark, N. J.

BUSINESS REPLY CARD

S FOR ELECTROPLATING SUPPLIES

Anodes

hes or longer, 5000 lb	
	53.42
	43.28
des, 2000 lb or more	54.00
lb lots	21.25
¢ per lb)	
olled carbon	$1.0225
dd 3¢ per lb)	
	$1.70
liptical per inch	$1.07
ight allowed in quantity)	

ary Metals

r oz	$35.00
, per oz	$2.25
s per lb	16.00
oz	$23 to $24
oz	$92 to $95
	$118 to $125
nts per troy oz	91.375

Chemicals

BORIC ACID, bbl.	9.95
CADMIUM OXIDE, 100 lb drum	$1.70
CAUSTIC SODA, 100 lb drum	8.50
CHROMIC ACID, flake type, 1 to 20 100 lb drums	31.75
COPPER CYANIDE, 100 lb drum	77.50
COPPER SULFATE, 5 or more 100 lb bags, per cwt	26.65
NICKEL CHLORIDE, freight allowed, 300 lb.	45.50
NICKEL SULFATE, 100 lb.	40.50
POTASSIUM CYANIDE, 100 lb drum N. Y.	48.00
POTASSIUM STANNATE, 100 to 300 lb drums	85.70
ROCHELLE SALTS, 250 lb	47.00
SODA ASH, 100 lb.	4.77
SODIUM CYANIDE, domestic, f o b N. Y., 200 lb drums	23.05
SODIUM STANNATE, 100 to 600 lbs.	68.80
ZINC CYANIDE, 100 to 900 lb	55.55
ZINC OXIDE, American process, lead free, 100 to 500 lbs.	16.5

(Cents per lb, f o b at point shipped)

Prices in effect March 15, 1957

le derived from authentic sources, may be expected to vary by geographic location, quantity
d other terms, market influences and variations. They are presented solely as a general guide.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed In the United States

PLATING
445 BROAD STREET
NEWARK 2, NEW JERSEY

Attn.: Reader Service Department

Book Order Card

☐ AES Member ☐ Non-Member

Please send me the following

.....

.....

.....

.....

.....

.....

This card is for ordering Books, ASTM-AES Specifications and Standards (No Charge) and PLATING Binders, $3.00

Enclosed is check money order for $..... (Payable to American Electroplaters' Society)

Name.....

Company Name..... Title.....

Address.....

City..... Zone..... State.....

If Non-Member ☐ Please send me literature about the American Electroplaters' Society

BOOKS

The Development of a Protective Coating Resistant to Nitric Acid and Hydrocarbons by D. F. Siddall, E. Hillier, R. Garling and M. Gunther. 116 pages; $3. (Order PB 121217S direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.)

X-200 resin has fulfilled Air Force requirements for a fluorinated material resistant to white fuming nitric acid encountered in nitric acid tanks and assist-take-off compartments of jet aircraft. Also known as Kel-F 800, the new polymeric fluorinated hydrocarbon derivative proved effective both as a lacquer coating and a filleting putty. The research program, which began in 1952, is reviewed in the illustrated report. The volume supplements a report of the same title previously released by OTS.

Principles of Laboratory Temperature Control, Electronic Relays, Thermistor Operated Control by C. M. Proctor. 55 pages; $1.50 (Order direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.)

A three-part report of research into devices for laboratory temperature control has been prepared for the Navy and released to industry.

Part 1 of the report is devoted to the principles of temperature control in the laboratory. Important factors in the design of water baths are discussed. The most-used types of temperature sensing elements are identified, and circuits are described for electronic relay controls for use with mercury regulators and thermistors.

Two types of electronic relays which can be built in the laboratory are described in Part 2. The first uses a low power pentode or dual triode, and the second a small thyratron. In both relays, the regulator contacts change the grid bias of the tube and carry a current of a few microamperes or less.

In Part 3, a thermistor operated controller is described which allows temperature to be set by a dial and controlled to plus or minus 0.01 C or better. A protective mount for use with a thermistor in a water bath is discussed.

Tinplate Handbook by W. E. Hoare, D.Sc., F.I.M., 3rd Revised Edition, 44 pages.

The book describes tinplate and how it is made. Section II gives figures for tinplate production up to the end of 1955. Section III, on manufacture, runs briefly through the steel-making and rolling processes and then outlines the two methods of tinning, by dipping in molten tin and by electrodeposition. Section IV on grades is by far the largest section of the book and is principally devoted to the key question of the thickness or weight of the tin coating. The units in use for measuring and quoting tin coating thickness or weight are:

The testing of tinplate, physical and chemical, and the usual routine tests which are useful are given. The application of various grades of tinplate are indicated.

The book is available free of charge from Tin Research Institute, Inc., 492 West 6th Ave., Columbus 1, Ohio.

The Electrolytic and Chemical Polishing of Metals in Research and Industry by W. J. McG. Tegart. Reviewed by Charles L. Faust. $4.50; AES members $4.10.

"The Electrolytic and Chemical Polishing of Metals" by W. J. McG. Tegart will be helpful to anyone interested in understanding of electropolishing mechanisms and applications, especially in metallographic preparations. The book is quite concise, having 129 pages including a bibliography of 213 references.

This book is well written and easy to read. The chapters devoted to Mechanism of Electropolishing, Electrical Characteristics of the Process, and Factors Influencing Polishing Conditions recognize the generally important principles. The discussion is brief, but readers can turn to the bibliography for more extended discussions of particular points.

More than twice as much space is devoted to laboratory electropolishing for metallographic applications (over half the book) as to industrial methods. Detailed tabulation of many procedures is given for laboratory (metallographic) polishing of metals and alloys of industrial interest, including metals such as nimonic alloys, niobium, titanium, thorium, uranium, vanadium, and zirconium which have assumed important roles in modern metallurgy and engineering. Many of the electrolytes listed for this laboratory use involve perchloric acid. Safe handling of perchloric is discussed and a ternary diagram shows stable and unstable compositions for perchloric acid—acetic acid baths.

The quite complete coverage of laboratory electropolishing baths and the discussions on theory would be very helpful to anyone starting out to develop a procedure for polishing special alloys in metallographic preparation. In this connection, there is a notable absence of photographs that would be most helpful for illustrating the principal advantages and limitations.

Electropolishing baths for metallographic preparation receive only short term use and are discarded so chemical control for prolonged use is not a factor and is not discussed. Formulations are cited for "industrial electropolishing" baths. These baths will operate as disclosed when freshly prepared, but completely missing is discussion of maintenance and control during the continuous use required for production. The reader in the United States who would get his first introduction to electropolishing might be misled by reference to some formulations as being good industrial electropolishing baths, which to this reviewer's knowledge receive no industrial attention. The predicament of the author regarding industrial application is understandable and no intent exists to unjustly criticize. The most used industrial electropolishing processes in the U.S.A. are proprietary and solution formulations are disclosed only in patents, to which the book refers. In the discussion, however, there is no mention of proprietary interest, and the reader must learn this fact by referring to the bibliography.

More could be said in the book about the advantages and limitations of industrial electropolishing. References that cover these aspects are given, but the reader will have to do much digging on his own. Direction on these aspects is given in a chapter in the Handbook of Electroplating Engineering, which is not included in Mr. Tegart's bibliography. This is not an oversight on his part, because the Handbook was not in print when he prepared his manuscript.

The technical literature contains much less information on chemical polishing than on electropolishing. Similarly, Mr. Tegart devotes relatively little attention to chemical polishing—13 pages in the 129 page book. Even though brief, the discussion is well oriented on principal aspects.

This book is recommended for persons engaged in materials control and development for metallurgical needs. The complete table of data for laboratory electropolishing methods and the extensive bibliography are sufficient reasons for this recommendation.

Stress Corrosion Cracking and Embrittlement—An Electrochemical Societies Series Technical Publication, Edited by William D. Robertson. Reviewed by A. M. Mendizza. $7.50; AES members $5.50.

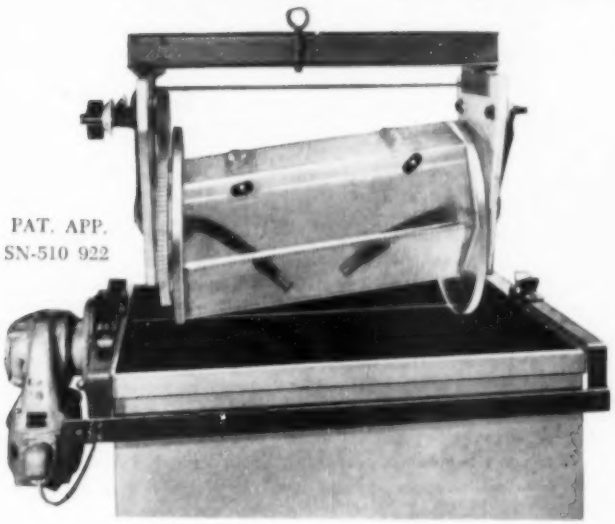
This synopsis, held under the auspices of the Corrosion Division of the Electrochemical Society comprises 14 papers by workers in four countries and covers some of the more important work on stress corrosion cracking done in the past decade and a half. The topics of the various papers range from an introductory presentation on the Phenomenon and Mechanism of Stress Corrosion Cracking, through individual treatments of this form of corrosion of several important metals of construction such as aluminum alloys, magnesium, austenitic stainless steel, to a dissertation on laboratory techniques for the investigation of stress corrosion cracking.

Perusal of the various papers leaves the reader with the general impression that the phenomenon of stress corrosion cracking is still somewhat of a mystery. Every metal, one is told, is subject to stress corrosion cracking providing the right conditions prevail. The reader, who might be looking for a panacea, is thus left with a

(*Continued on page 398*)

How Much are YOU Losing with conventional cylinders

our guess is $100.00 per month per cylinder



PAT. APP.
SN-510 922

Uniform Plating makes the difference

With BELKE DOUBLE OSCILLATING CYLINDERS triple mixing action stirs, turns and moves the work across the cylinder. Every side of every piece gets uniform exposure to plating current.

You eliminate under-plating and over-plating. You don't have to over-plate most of the work to get the minimum deposit required on all the pieces.

You reduce plating time up to 20% with corresponding savings in plating metal and current.

What's more you turn out barrel plating quality never before equalled—avoid complaints, eliminate rejects, stripping and rerunning.

Modernize Your Plating Barrels with BELKE Rock and Roll Cylinders.

BELKE Double Oscillating Cylinders are available in all sizes from 14x36 regulars to 6x12 portables in complete plating units or to replace present cylinders.

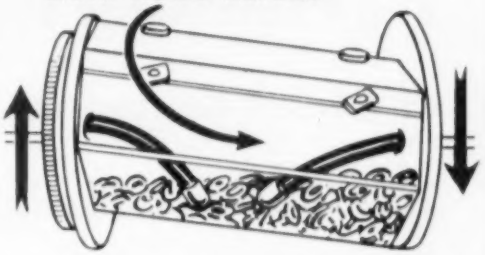
Write or ask your BELKE SERVICE ENGINEER.

The Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51

EVERYTHING FOR PLATING PLANTS

Each Revolution

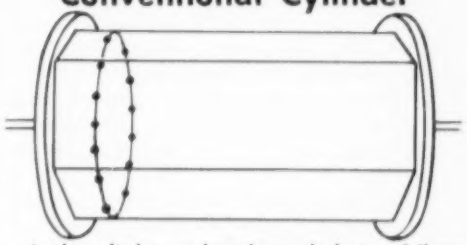
work flows across



work flows back

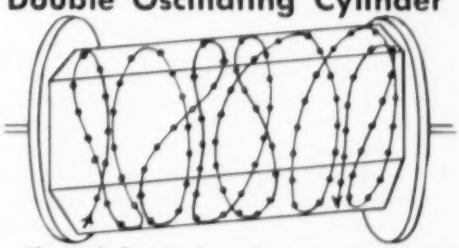
A marked piece shows the way the work goes!

Conventional Cylinder



As the cylinder revolves the marked piece follows a fixed path round and round the inside wall.

Double Oscillating Cylinder



The marked piece shows the progressive figure 8 mixing action added by double oscillation. The work pours back and forth as well as round and round.

Individual pieces move from end to end of the cylinder. They roll, twist and turn. None remains buried.

All sides of every piece are uniformly exposed to plating current. *That's why Double Oscillating Cylinders give you uniform plating deposit not obtainable with conventional cylinders, in less plating time and at reduced plating cost.*

The Photometric Determination of Molybdenum in Zinc Cyanide Plating Solutions

by J. P. Leffin*

THIS PAPER PRESENTS an improved procedure for the photometric determination of molybdenum in zinc cyanide plating solutions. The method is rapid and has good precision and accuracy. The color produced is stable for at least 2 hours, follows Beer's law, and requires no extraction from the water phase.

The addition of small quantities of molybdenum to zinc cyanide plating solutions for the purpose of producing a bright zinc plate has made the analytical control of this element a necessity. The usual procedure employed[1] involves acid treatment of the sample, evaporation to fumes of sulfuric acid, precipitation, filtration and washing, adjustment of the acidity, reduction and finally titration with potassium permanganate solution. The method is quite lengthy, and at times has given difficulty due to a fugitive end-point. The investigation described in this paper was initiated with a view to developing an improved procedure.

The relatively small concentrations of molybdenum to be dealt with suggested the possibility of determining the element photometrically. A survey of the literature produced one paper on the application of this method to zinc cyanide plating solutions.[2] In this paper the authors used visual or photometric comparison of the color developed in the sample, by the molybdenum-thiocyanate-stannous chloride reaction with that produced in a series of standards containing known quantities of molybdenum. The recommended procedure required calibration standards to be prepared for each new set of determinations, and also required that calibration be performed at different wave lengths, depending on the molybdenum concentration. The advantages of a method that did not require constant recalibration, and with a single calibration curve valid for all expected concentrations of molybdenum seemed self-evident. With these objectives in mind, a literature investigation of the chemistry of the reaction was made.

A General Electric Company internal publication by A. P. Scanzillo and S. J. Gootman of the Thomson Laboratory of the Lynn River Works on the "Colorimetric Determination of Molybdenum in Alloy Steels" presented an excellent literature coverage in this area.

Based on an experimental study, the authors present a modified thiocyanate-stannous chloride procedure, using butyl Carbitol to stabilize the color as proposed by Kapron and Hehman[3] and subsequently recommended by Kirtchik.[4] The method seemed to meet the criteria mentioned in the previous paragraph for an improved determination, and its application to zinc cyanide plating solutions was investigated.

EXPERIMENTAL PROCEDURE AND RESULTS

A series of solutions containing known quantities of molybdenum were treated by the proposed procedure. A plot, on semi-log paper, of per cent transmittance versus molybdenum concentration gave a straight line, showing that the color produced obeyed Beer's law. The data are shown in Table I, the plot of the data is shown in Fig. 1.

Four determinations were run on each of two samples of zinc cyanide plating solutions from the factory subsection. The results obtained showed good reproducibility, as shown in Table II.

TABLE I
STANDARD MOLYBDENUM CURVE DATA

Mg Mo/100 ml	Per Cent Transmittance
0.050	79.0
0.100	61.0
0.150	48.8
0.200	39.3
0.250	32.0
0.300	26.0

* Measurements Laboratory, Instrument Department, General Electric Company, West Lynn, Mass.

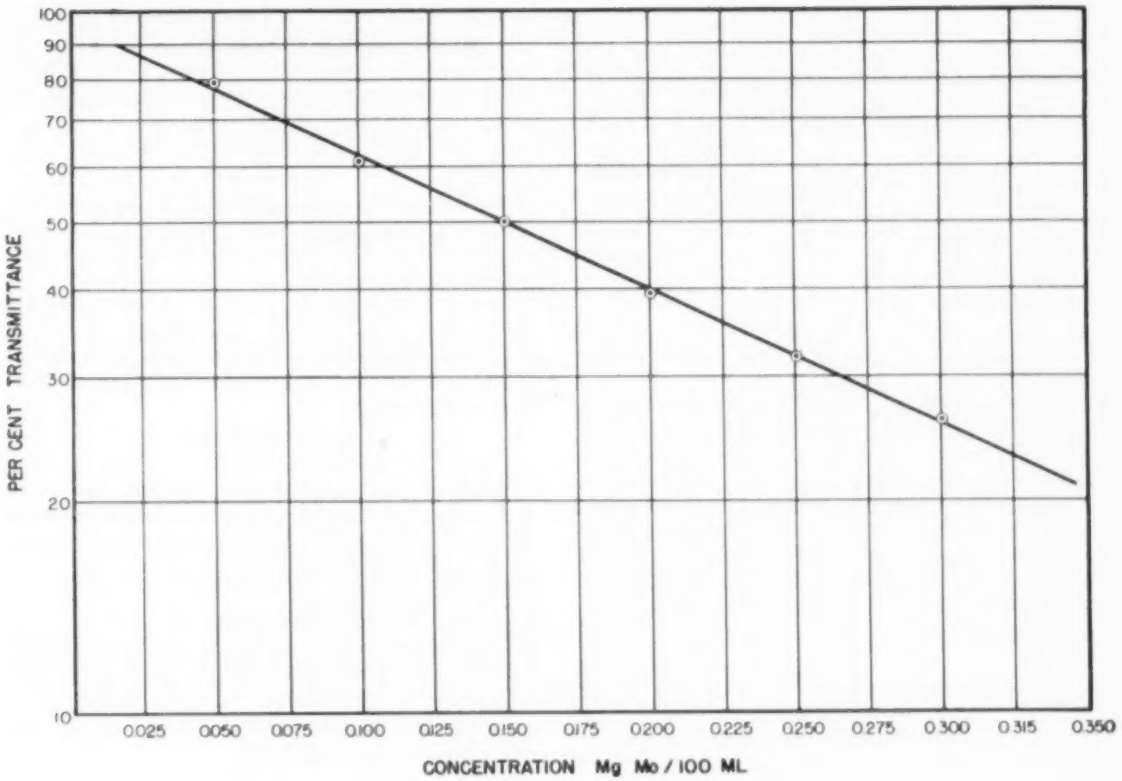


Fig. 1

The solutions obtained in the previous paragraph were allowed to stand under room conditions and readings taken at hourly intervals. The stability of the color was satisfactory for at least two hours, the average change during this period being −0.003 oz/gal of molybdenum, with a spread of −0.001 to −0.005 oz/gal.

The proposed procedure was turned over to our plating analyst as a routine procedure and a comparison run with the volumetric method over a period of six weeks. The correlation between the two methods is good, as shown by a representative day's results in Table III. The working time involved in both methods was also checked and it was found that for four samples a net savings of one hour could be realized by the photometric over the volumetric method.

ANALYTICAL PROCEDURE

The detailed analytical procedure follows.

APPARATUS

Photometric equipment: A Coleman model 14 spectrophotometer using 19 by 105 mm test tube cuvettes was employed. A filter photometer would be entirely satisfactory. Cells of dimensions other than that used in this work would, of course, require compensating variations in the molybdenum concentration.

REAGENTS AND SOLUTIONS

Standard molybdenum solution, 0.25 mg Mo/ml; dissolve 0.6305 g of sodium molybdate, $Na_2MoO_4 \cdot 2H_2O$, in 100 ml of water. Make up to one liter in a volumetric flask and mix well.

Hydrochloric acid solution, 5:95, cooled to room temperature.

Iron Solution: to 23 g of ferric sulfate add 200 ml of

TABLE II

REPRODUCIBILITY OF THE PROCEDURE

Sample	Test No.	Oz/gal Molybdenum
No. 1 Zinc Cyanide	1	0.182
No. 1 Zinc Cyanide	2	0.178
No. 1 Zinc Cyanide	3	0.178
No. 1 Zinc Cyanide	4	0.182
No. 2 Zinc Cyanide	1	0.173
No. 2 Zinc Cyanide	2	0.178
No. 2 Zinc Cyanide	3	0.177
No. 2 Zinc Cyanide	4	0.175
Standard deviation		0.0023

TABLE III

COMPARISON OF PHOTOMETRIC AND VOLUMETRIC METHODS

Sample	Oz/gal Molybdenum	
	Photometric	Volumetric
No. 1 Zinc Cyanide	0.158	0.16
No. 2 Zinc Cyanide	0.161	0.17
No. 3 Zinc Cyanide	0.195	0.19
No. 4 Zinc Cyanide	0.199	0.20

sulfuric acid and 200 ml of 85 per cent phosphoric acid. Stir water in slowly until a clear solution results. Dilute to 1 liter and cool to room temperature.

Sodium thiocyanate solution, 50 g/l.

Stannous chloride solution: dissolve 15 g of stannous chloride, $SnCl_2 \cdot 2H_2O$, in 25 ml of hydrochloric acid, heating until a clear solution results. Dilute to 100 ml and cool to room temperature. Due to the instability of this solution it has been found convenient to prepare it freshly as needed.

PREPARATION OF THE STANDARD MOLYBDENUM CURVE

Prepare six 250-ml beakers containing respectively exactly 2, 4, 6, 8, 10 and 12 ml aliquots of the standard molybdenum solution. Add 5 ml of sulfuric acid and evaporate to white fumes. Cool, add 45 ml of 5:95 hydrochloric acid solution and cool to room temperature. Transfer to 100 ml volumetric flasks with 5:95 hydrochloric acid solution, make up to the mark with the same acid solution and mix well. Transfer a 10 ml aliquot to a 100-ml volumetric flask, add 10 ml of iron solution, 25 ml of 5:95 hydrochloric acid solution and 15 ml of butyl Carbitol (diethylene glycol mono-n-butyl ether). Mix until a single phase results. Add 5 ml of sodium thiocyanate solution and mix for 30 seconds. Add 10 ml of stannous chloride solution and mix for 30 seconds. Make up to the mark with 5:95 hydrochloric acid solution, mix well, allow to stand 10 minutes. Measure per cent transmittance of each solution at 475 mu, using distilled water to set the instrument at 100 per cent transmittance. Plot per cent transmittance against mg of Mo/100 ml of solution on semi-log paper. To avoid computation it was found convenient to convert mg of Mo/100 ml to oz/gal of Mo.

DETERMINATION OF MOLYBDENUM IN ZINC CYANIDE SOLUTIONS

Pipette a 1 ml sample into a 250 ml beaker, cover and add 5 ml of sulfuric acid (in the hood). Heat to heavy white fumes, cool for a few minutes, add 5 ml of nitric acid and heat to heavy white fumes again. This treatment should destroy all organic matter present. Cool, add 5 ml of hydrochloric acid and heat to white fumes again. Treat as described in the previous paragraph starting with "cool, add 45 ml of 5:95 hydrochloric acid solution" and ending with "using distilled water to set the instrument at 100 per cent transmittance." Pick off on the standard curve the oz/gal of molybdenum corresponding to the observed per cent transmittance.

REMARKS

The standard molybdenum curve, using the prescribed schedule of aliquoting, covers the range of 0 to 0.45 oz/gal of molybdenum. By suitably reducing the sample aliquot, higher ranges can be covered; for instance, by using a 5 ml aliquot, the range can be extended to 0.9 oz/gal, etc.

Reagents in all cases are reagent grade, and water in all cases is distilled. Unless otherwise specified, acids used are concentrated.

CONCLUSION

An improved method for the photometric determination of molybdenum in zinc cyanide plating solutions has been developed. A saving in time of approximately 15 minutes per determination can be realized.

ACKNOWLEDGMENT

The author wishes to acknowledge the encouragement and support of R. S. Norman of this laboratory in this work as well as the cooperation of E. G. Holmgren Jr. in carrying out the comparison of the photometric and volumetric procedures.

REFERENCES

[1]Modern Electroplating, The Electrochemical Society, pg. 374 (1942).

[2]Silverman, L., Stewart, V. and Davies, J., Metal Finishing, **44,** 426-8, (1946).

[3]Kapron, M., and Hehman, P. L., Ind. Eng. Chem., Anal. Ed., **17,** 573, (1945).

[4]Kirtchik, H., General Electric Co., Private Communication.

J. P. Leftin is a graduate of Franklin Union Technical Institute in Boston, Massachusetts, in the field of Industrial Chemistry. His varied industrial experience includes three years as a plating foreman and 25 years as an analytical chemist. Since 1941, he has been in charge of the Analytical Laboratory of the Instrument Department of the General Electric Company, West Lynn, Massachusetts.

The Determination of Copper in Nickel Solutions

by Thomas A. Downey*

INTRODUCTION

Several years ago, there appeared in the analytical chemical literature[1, 2, 3, 4] a sensitive specific colorimetric procedure for the determination of copper. This procedure was based on the formation of a yellow colored complex which was produced by the interaction of cuprous copper and neo-cuproine (2-9 dimethyl 1-10 phenanthroline). This yellow metallic organic complex was extracted into chloroform and the absorbancy of the chloroform extract was determined. The absorbancy value was then converted to the milligrams of copper present in the sample by reference to a previously standard curve.

Since this procedure was quite specific for copper, required relatively few reagents and was quite easily performed, it was decided to try to apply this method to the determination of copper in nickel solutions. The following procedure was developed using this method and the outlined experimental work was performed to test its application.

METHOD

A. Reagents and Special Equipment†

1. Standard copper solutions.

Dissolve exactly 1.000 g of copper wire in a minimum amount of 1:3 nitric acid by gentle heating. After the copper has dissolved, dilute the solution with 20 to 30 ml of water and boil gently to expel any oxides of nitrogen. Quantitatively transfer the solution to a liter volumetric flask, dilute the solution to the mark and shake thoroughly. Then pipette a 10.00 ml aliquot from this solution into a liter volumetric flask, dilute to volume and shake thoroughly. This final dilution is the working standard dilution and each ml contains 0.0100 mg of copper.

2. Reagent grade alcohol.‡

3. Chloroform†† ($CHCl_3$).

4. 0.100 per cent alcoholic neo-cuproine solution.

Dissolve 0.250 mg of neo-cuproine‡‡ (2-9-dimethyl 1-10 phenanthroline) in sufficient reagent grade alcohol to make exactly 250 ml. When initially prepared, the solution should be colorless or have only a slight yellow color. If the solution is quite yellow in color, the alcohol is impure. By using analytical reagent alcohol, such as the type described above, no such difficulty should be encountered. This solution of neo-cuproine has been found to be stable for at least two to three months when stored under normal laboratory conditions.

5. Ten per cent hydroxylamine hydrochloric solution.

Dissolve 25 g of hydroxylamine hydrochloride ($NH_2OH \cdot HCl$) in 250 ml of water. This solution is then purified as follows: Transfer the solution to a 1000 ml separatory funnel and add 25 ml of the 0.100 per cent neo-cuproine solution. The solution is then shaken with 10 ml portions of $CHCl_3$ until the $CHCl_3$ extracts are no longer yellow. If considerable copper is present in the $NH_2OH \cdot HCl$, it may be necessary to add 10 ml more of the neo-cuproine solution and repeat the $CHCl_3$ extraction.

6. Thirty per cent sodium citrate solution.

Dissolve 150 g of sodium citrate ($Na_3C_6H_5O_7 \cdot 2H_2O$) in sufficient water to make 500 ml. This solution is then purified in the same manner as the 10 per cent $NH_2OH \cdot HCl$ solution.

7. Four per cent sodium fluoride solution.

Dissolve 40 g of sodium fluoride (NaF) in sufficient distilled water to make one liter. Filter the solution, if necessary, and store in a polyethylene bottle. It was not found necessary to purify this reagent.

8. One 1000 ml capacity separatory funnel.*

9. Four to six separatory funnels,* capacity 125 ml.

10. Colorimeter or spectrophotometer.†

11. Four to six ml capacity glass stoppered volumetric flasks.

B. Procedure.‡

1. Pipette a 25.00 ml of the nickel solution to be analyzed into a 125 ml separatory funnel† and dilute to 50 ml with water.

2. Add 5 ml of the 10 per cent hydroxyamine hydrochloride solution and 10 ml of the 30 per cent sodium citrate solution. Stopper the separatory funnel and shake the solution thoroughly after each addition.

3. Pipette 10.0 ml of the 0.10 per cent neo-cuproine solution into the separatory funnel, stopper the funnel then shake the solution for 10 to 20 seconds. If considerable copper is present in the solution, it will take on a yellowish cast.

4. Add 5 ml of the sodium fluoride solution, stopper the flask and shake the solution for 5 to 10 seconds.

5. Adjust the pH to 4.0 to 6.0 with either hydrochloric acid or ammonium hydroxide using pH papers. This pH adjustment is usually not necessary for a nickel solution, whose initial pH is between 3.0 to 4.5.

6. Add 10 ml of chloroform to the separatory funnel and shake the solution thoroughly for 30 to 40 seconds.

7. Allow the chloroform phase to settle out and clarify. If copper is present in the sample, the chloroform layer (bottom) will be yellow; the depth of the color depending upon the amount of copper present. The aqueous phase

*Analytical Chemist, J. C. Miller Division, Hanson-Van Winkle-Munning Company, Grand Rapids, Michigan.

†All the chemicals used should be of American Chemical Society grade and the water must be copper free distilled or deionized water.

‡J. T. Baker's Alcohol Reagent, commodity number 5-9400, was found satisfactory.

††J. T. Baker's, Baker Analyzed reagent chloroform was found satisfactory.

‡‡Can be obtained from G. F. Smith Chemical Co., Columbus, Ohio.

*Squibb.

†The Beckman D. U. Spectrophotometer was used with excellent results, however, an equivalent spectrophotometer or a colorimeter can be used.

‡All the glassware used must be thoroughly cleaned and rinsed in order to avoid any chance of contamination with copper.

may become somewhat turbid but this will in no way interfere with the procedure.

8. Carefully draw off the chloroform layer into a 50 ml volumetric flask which contains 5 to 10 ml of reagent grade alcohol. It is best to use a funnel for this transfer in order to avoid any loss of the chloroform solution.

9. Rinse the stem of the separatory funnel by adding 2 ml of chloroform and draw off the chloroform into the 50 ml volumetric flask. The 2 ml of chloroform should be added to the separatory funnel so as to remove any droplets of chloroform which may be floating on the surface of the aqueous phase.

10. Add 6 ml more of chloroform to the separatory funnel and shake the solution thoroughly for 30 seconds. After the chloroform has settled and clarified, draw it off into the 50 ml volumetric flask.

11. Repeat step 9.

12. Dilute the contents of the flask to the mark with reagent grade alcohol then stopper the flask and mix thoroughly.

13. Determine the absorbance of the ethanol chloroform solution at 457 mμ in a one centimeter cell, using a spectrophotometer.† If a colorimeter is employed, use a blue filter.‡ A mixture of 3 volumes of the reagent alcohol (denatured ethanol) and 2 volumes of chloroform is used to set the instrument at 100 per cent transmittance (0.000 adsorbance). Since the yellow color of the copper neo-cuproine complex is quite stable for at least 5–10 hr, when exposed to normal laboratory lighting conditions, the absorbance of the extract need not be determined immediately.

14. A reagent blank determination should be run along with the sample. The reagent blank procedure is identical with the sample procedure, only instead of using 25 ml of nickel solution, 25 ml of distilled water is used. For the pH adjustment in step 5 about 0.6 ml of concentrated hydrochloric acid will be required.

15. Subtract the blank absorbance reading from the sample absorbance reading. Using this corrected absorbance reading, determine the amount of copper present in the 25 ml sample by referring to a previously prepared standard curve. If the corrected absorbance is too great to be read from the standard curve, repeat the determination using a smaller sample.

16. Multiply the amount of copper found in the 25 ml sample by 40 to obtain the mg/l of copper present in the nickel solution. (Mg/l = ppm). If a smaller sample of nickel is used, the calculations must be corrected accordingly.

17. The standard curve is prepared by taking separate 0.00, 5.00, 10.00, 15.00, 20.00 and 25.00 ml aliquots from the copper working standard and proceeding as outlined for the sample. It is not necessary to use a copper-free Watts solution for preparing the curve. For the pH adjustment in step 5, about 0.6 ml of concentrated hydrochloric acid will be required to adjust the pH to 5.0. This standard curve should be run in duplicate for accurate results. A plot of corrected absorbance values versus the concentrations of copper used should result in a straight line (Fig. 1).

†Beckman or its equivalent.
‡Such as Fisher's Electrophotometer blue 425 B filter.

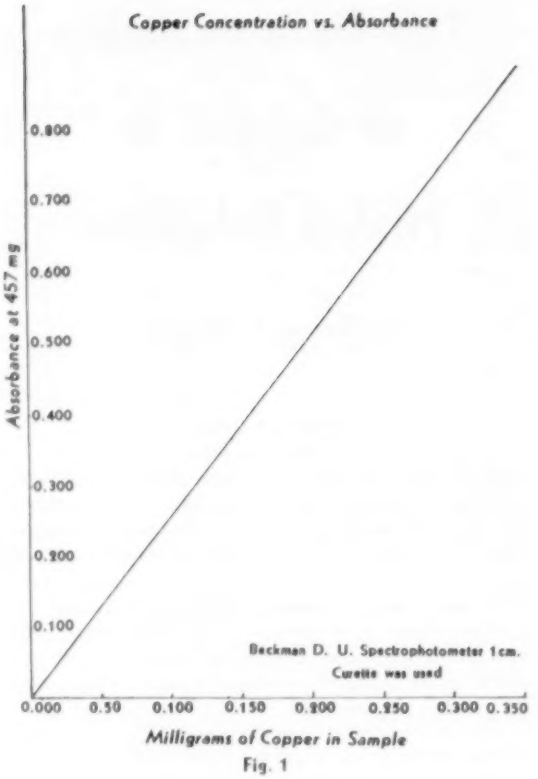


Fig. 1

EXPERIMENTAL

A. In order to test the possible influences of the constituents of a Watts nickel bath upon this determination, a standard Watts nickel bath was prepared from agent reagent chemicals. This solution analyzed as follows:

Nickel	10.8 oz/gal
Nickel Chloride	7.8 oz/gal
Boric Acid	4.5 oz/gal

To 25 ml aliquots taken from this pure Watts solution,

TABLE I

Recovery of Copper added to Watts Solution

Ml of Watts Solution taken	Copper added	Copper found	Per cent Recovery
25.00	0.000 mg	0.0039 mg*	
25.00	0.0295 mg	0.0296 mg	100
25.00	0.0589 mg	0.0576 mg	98
25.00	0.118 mg	0.117 mg	99
25.00	0.236 mg	0.233 mg	99

*This small amount of copper is due to the traces of copper in the chemicals used to prepare the Watts solution. The mg of copper found and the per cent recovery are corrected for this small amount of copper.

various amounts of copper were added and the solutions were analyzed in duplicate. Table I contains a summary of the results obtained and clearly shows that this procedure is applicable to a pure Watts solution.

B. Impurities.

Since the majority of nickel solutions contain various amounts of inorganic impurities, a portion of the pure Watts solution was contaminated with the chemicals shown in Table II. The quantities of impurities added to the Watts solution are, in most cases, considerably greater than those found in nickel plating solutions. To test the influence of these impurities on the determination, various amounts of copper were added to 25.0 ml aliquots of this contaminated Watts solution. These solutions were then analyzed in duplicate using the procedure as outlined. Table III contains a summary of the results obtained and again shows that none of the common impurities found in nickel solutions interfere with the accuracy of the results.

TABLE II

Impurity	Salt Used	Concentration of Impurity in ppm
Aluminum	$AlNH_4(SO_4)_2 \cdot 12H_2O$	200
Cadmium	CdO	200
Calcium	$CaSO_4 \cdot 2H_2O$	Saturated
Trivalent Chromium	$Cr_2(SO_4)_3 \cdot nH_2O$	150
Hexavalent Chromium	CrO_3	10
Cobalt	$CoSO_4 \cdot 7H_2O$	100
Iron	$FeSO_4 \cdot 7H_2O$	150
Lead	$Pb(NO_3)_2 \cdot 6H_2O$	500
Manganese	$MnSO_4 \cdot 4H_2O$	150
Zinc	$ZnSO_4 \cdot 7H_2O$	150

C. Addition Agents

Since it would be impractical to check the influence of the great variety of nickel addition agents commercially available upon this procedure, no systematic study was made of their effect. However, if the procedure is to be used for the determination of copper in bright organic nickel solutions, it is easy to check the influence of the brighteners. This is accomplished by preparing a sample of a bath which contains the usual amounts of brighteners. This solution is then analyzed for copper by this method.

TABLE III

Ml of Watts Solution taken	Copper added	Copper found	Per cent Recovery
25.00	0.000 mg	0.013 mg*	
25.00	0.0295 mg	0.0304 mg	103
25.00	0.0589 mg	0.0606 mg	103
25.00	0.118 mg	0.118 mg	100
25.00	0.236 mg	0.234 mg	99

*This copper is due to the copper impurities in the chemicals used to prepare this contaminated solution. The mg of copper found and the per cent recovery are corrected for this copper.

The next step is to add some copper to the bath (or to a 25 ml sample) and test the recovery of the copper added. If the recovery of the copper is within ± 5 per cent of the copper, it can be assumed that the brighteners have little or no influence upon the procedure. It is the author's opinion that most addition agents will not be found to interfere with the procedure since the few brighteners tested had no effect.

SUMMARY

The determination of copper in nickel solutions described in this paper has several features which make it a valuable method for routine and nonroutine use in the laboratories of the electroplating industry. The reagents are quite stable, therefore, removing the annoying features of preparing fresh reagents, for occasional analysis. Secondly, the procedure is quite specific and simple. The use of chloroform, which is heavier than the nickel solution, simplifies the extraction of the copper neo-cuproine complex. Thirdly, this method is quite sensitive since it is possible to determine one mg of copper in a liter of nickel solution with an accuracy greater than ± 5 per cent. Finally, because the copper neo-cuproine complex in the ethanol-chloroform mixture is quite stable, the absorbance of the solution need not be determined immediately. This stability of the copper complex makes it possible to run copper standards along with a sample or group of samples and then determine the approximate copper content of the sample or samples by visual comparisons between the standards and sample.

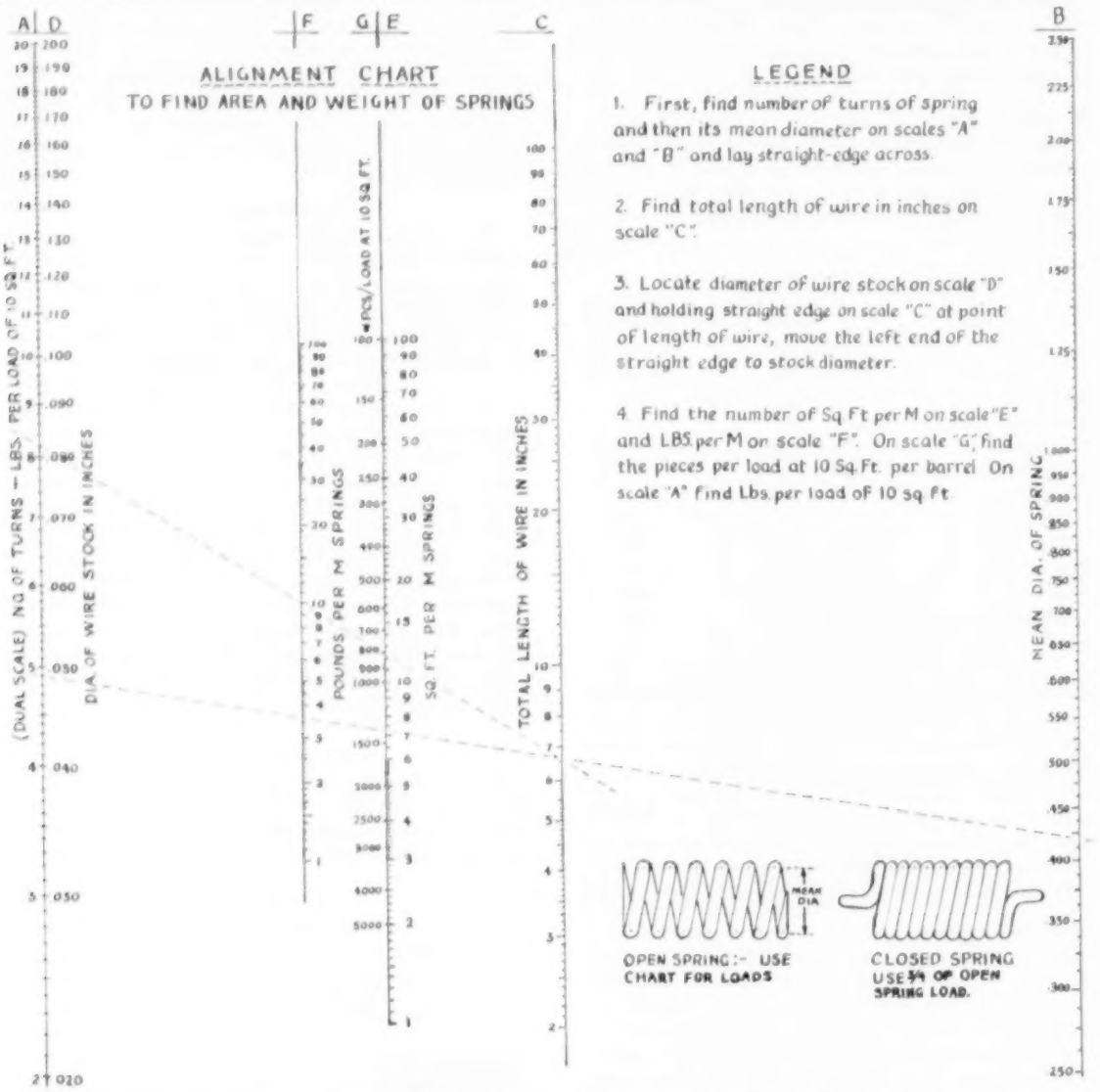
ACKNOWLEDGMENT

The author wishes to express his gratitude to Mr. T. J. Mooney of the Matawan Hanson-Van Winkle-Munning Company Laboratory, for assistance he gave him with the experimental work involved in this paper.

REFERENCES

[1]Smith, G. F. and McCurdy, W. H., "Analytical Chemistry," **24,** 371 (1952).
[2]Luke, C. L. and Campbell, M. E., Ibid, **25**, 1588 (1953).
[3]Gahler, A. R., Ibid, **26,** 577 (1954).
[4]Fulton, J. W. and Hasting, J., Ib d, **28,** 174 (1956).

T. A. Downey was born in New York City in 1926. He received a BA degree in Chemistry from NYU, thereafter worked for Charles Pfizer and Co., Brooklyn. He was awarded an MS degree in Analytical Chemistry from Polytechnic Institute of Brooklyn in 1953. He has extensive experience in analytical instrumentation. He joined Hanson-Van Winkle-Munning Co. in April 1953, as head of the analytical laboratories. His aim there was to develop new instrumental analytical methods and revise and improve standard procedures, and has succeeded in applying polarographic and spectrophotometric procedures to numerous plating salts and solutions. In September 1955, Mr. Downey was placed in charge of the analytical laboratories of H-VW-M at Grand Rapids. He is married, has one son, and is a member of the Grand Rapids Branch of the AES and Western Michigan Branch of the ACS.


ALIGNMENT CHART
TO FIND AREA AND WEIGHT OF SPRINGS
LEGEND
1. First, find number of turns of spring and then its mean diameter on scales "A" and "B" and lay straight-edge across.
2. Find total length of wire in inches on scale "C".
3. Locate diameter of wire stock on scale "D" and holding straight edge on scale "C" at point of length of wire, move the left end of the straight edge to stock diameter.
4. Find the number of Sq Ft per M on scale "E" and LBS. per M on scale "F". On scale "G" find the pieces per load at 10 Sq. Ft. per barrel. On scale "A" find Lbs. per load of 10 sq. ft.
A
D
F
G
E
C
B
(DUAL SCALE) NO. OF TURNS — LBS. PER LOAD OF 10 SQ. FT.
DIA. OF WIRE STOCK IN INCHES
POUNDS PER M SPRINGS
*PCS/LOAD AT 10 SQ. FT.
SQ. FT. PER M SPRINGS
TOTAL LENGTH OF WIRE IN INCHES
MEAN DIA. OF SPRING
MEAN DIA
OPEN SPRING:- USE CHART FOR LOADS
CLOSED SPRING USE ¾ OF OPEN SPRING LOAD.

ALIGNMENT CHART FOR FINDING WEIGHT AND AREA OF SPRINGS

by George C. Field*

The chart shown was developed as a means of estimating barrel loads for zinc plating springs. Information needed was area (in square feet) and weight (in pounds) per 1000 pieces.

The number of turns and the mean diameter of the spring to be measured may be taken from the blue print of the spring, or if no blue print is available, subtract the diameter of wire stock in inches, from the outside diameter of the spring in inches, which will be the mean diameter.

(Continued on the next page)

* Routing Department Planner, Cutler-Hammer, Inc., Milwaukee, Wisconsin.

Plating on Aluminum Bronze

by I. William Marcovitch

RECENTLY IN another publication, advice was sought by a reader on a method to obtain an adherent deposit of silver on aluminum bronze.

Aluminum bronze presents difficulties in plating due to the aluminum, silicon, iron and nickel constituents present in not insignificant amounts.

The experience of the writer in overcoming plating adhesion difficulties is offered with the view that it may aid in producing sound deposits on this alloy.

The part involved was a forging of aluminum bronze (ASTM Specification B 150, Type I). It was bright nickel plated and then subjected to a furnace brazing cycle of 1310 F for 20 min. in an atmosphere of nitrogen. Although the nickel deposit appeared sound when examined visually and also when subjected to a heat test in hot oil at 485 F for five minutes, there was failure of the plating bond on all of the parts after the brazing cycle.

The cleaning cycle at that time was that used for brass and included double electrocleaning and acid dips, followed by a copper strike and then bright nickel plated for four minutes at 30 asf.

After the adhesion failure, various cleaning cycles were tried, including satin finishing the basis metal, a five minute soak in 25 per cent (vol.) hydrofluoric acid and a Wood's nickel strike, with no success in obtaining satisfactory bonding of the deposit when subjected to the brazing temperature.

The problem has been solved by dipping the parts prior to plating in a solution of:

Nitric acid (conc.)	100 fl oz
Ammonium bifluoride	11 oz
Water	To make 1 gal
Temperature	Room
Time	3 sec

This solution is contained in a polyethylene drum equipped with adequate ventilation facilities.

The cleaning and plating procedure is:

(a) Electroclean in a brass cleaner
(b) Dip in hydrochloric acid (15 per cent vol., room temperature)
(c) Dip in nitric acid-ammonium bifluoride solution (as above)
(d) Repeat (a) and (b)
(e) Copper cyanide strike
(f) Nickel plate
(Rinse thoroughly between steps.)

The nitric acid-ammonium bifluoride solution removes the aluminum and silicon from the surface, etching it very slightly. Thus, a good adhesion base is provided for the copper strike and nickel plating.

The same procedure should give good results with other electroplated metals.

* Plant Chemist, American Machine & Metals, Inc., U. S. Gauge Div., Sellersville, Pa.

Alignment Chart

(Continued from opposite page)

Those values are then located on scales A and B respectively. Scale C has been calculated to multiply the mean diameter by pi and the number of turns so as to give total length of wire at the point of intersection of a line imposed between scales A and B.

The next step is to find the surface area of the wire. Having obtained the length of wire at the intersection point on scale C, it is projected to a point on scale D where the diameter of wire stock has been found. The points where this line intersects scale E and F will give square feet per thousand and pounds per thousand respectively. The number of pieces for a 10 sq ft load may be read at intersection point on scale G and the number of pounds for a 10 sq ft load on scale A.

Barrel loads of springs whose coils are closed are reduced to 75 per cent of the equivalent load of open coiled springs. The reduced load has been found necessary to provide adequate power into the deep recesses.

Common shop practice is to specify, on manufacturing orders, the number of pieces per barrel load and the weight of that load, in pounds. For instance, the example plotted on the chart shows a proper load of 800 pieces with a total weight of 8.2 lb and would be specified as 800 C 8¼, the letter indicating the type of barrel to be used. While the values derived from the chart are approximate, they are sufficiently accurate to be practical.

George C. Field, veteran systems specialist for Cutler-Hammer, Inc., electrical manufacturer, has had broad experience in plating systems and methods simplification planning in the industrial field. In addition to writing technical articles, Mr. Field has found time to become an accomplished artist and philosopher.

MICROTHROWING POWER

A Literature Search

by Esther B. Leffler† and Henry Leidheiser Jr.‡

Location:
Virginia Institute for Scientific Research
Richmond, Virginia

Project Directing Committee:
Walter R. Meyer
Chairman
D. Gardner Foulke
R. T. Putnam
James D. Thomas

Introduction

The necessity for developing techniques for electroplating in the pores of powder compacts, the necessity for retaining high fidelity in the replication of phonographic masters, and the necessity for depositing within recesses of intricately-shaped pieces all have aided in building up a fund of knowledge among platers concerned with the problem of throwing power on a micro scale. Most of this know-how is retained as part of the art of electroplating and very little reaches the printed page and becomes incorporated in the general knowledge of the field. The purpose of this report is to summarize the published experimental and theoretical work concerned with the electrodeposition of metals in isolated surface cavities. This summary will serve as the backdrop against which decisions will be made concerning the experimental approach to Project No. 17 of the American Electroplaters' Society.

The report is divided into four sections. The first section is a summary of the ways in which words such as leveling, throwing power, covering power, etc. have been used. The second section reviews the experimental work on microthrowing power and leveling which is pertinent to the objectives of Project No. 17. In the third section a survey is given of the limited theoretical work concerned with deposition within isolated recesses and cavities. Finally, the experimental approach to be used in the initial work is outlined in the fourth section.

Usage of Terms*

So far as is known to the present authors the term *microthrowing power* was not used in the literature prior to Reinhard's paper[1] in 1950. At the 1950 AES meeting the term was used in discussion to refer apparently to throwing power on a micro scale, that is, to metal distribution where small recesses are concerned. There was no agreement about the relation between ordinary throwing power and microthrowing power, nor was there any agreement about the relation between microthrowing power and leveling. The confusion apparent then still exists.

Kronsbein[2] has adequately reviewed the history of the concept of *throwing power* in connection with his work on current and metal distribution (AES Research Project No. 11). The term throwing power usually refers to deposit thickness distribution, and the throwing power of solutions is compared using cells of standard shape and size.[3] Various people[2, 3, 4, 5, 6, 7] have discussed the limitations of the concept of throwing power and of the methods of measuring it, and the inapplicability of the results to practical cases. More recently Pinner[8] has discussed the methods of measuring and the factors affecting throwing power and covering power.

Covering power is a term which has been used in many different ways. According to some,[2, 8, 9, 10, 11] covering power is distinct from throwing power; to others, covering power is synonymous with throwing power. Covering power has been used to mean the ability to deposit to the edge of a hole,[12] the ability to deposit on the rear of a specially-shaped cathode in a reasonable time,[13] the ability to cover the cathode completely,[10] and the extent to which metal will begin to deposit on different parts of the cathode.[8] Blum and Hogaboom[3] have suggested that the term covering power should be used as a qualitative measure of the ability to cover the entire surface of a cathode and that throwing power be used as a more quantitative term expressing deposit distribution. According to Pinner,[8] covering power must be carefully distinguished from throwing power since the former involves only the onset of deposition before polarization sets in. He considers most of the early tests of metal distribution such as the bent cathode and cavity scale tests to be tests of covering power, not throwing power. In spite of ambiguities of usage, the term throwing power does represent a real phenomenon with which the practical plater is familiar; for example, the throwing power of cyanide copper solution is better than that of acid copper.

The case of acid copper vs. cyanide copper led to the use of the term *microthrowing power*. Meyer[14] and Graham *et al.*[15] found that in plating on a porous

† Summer participant. Chairman, Department of Chemistry, Sweet Briar College, Sweet Briar, Virginia.
‡ Assistant Director, Virginia Institute for Scientific Research, Richmond, Virginia.

* When this report was written, one of the objectives was to propose definitions for the various terms to be used. After considerable thought, it was decided to postpone the presentation of working definitions until we became more deeply involved in the experimental program. The present plan is to introduce the first experimental report with suggested definitions approved by the Project No. 17 Committee.

metal surface, acid copper had better microthrowing power than cyanide copper, and Meyer pointed out that ordinary ideas of throwing power are not valid if crevices are minute. Reinhard[1] used the term for deposition into grooves or scratches or holes of microscopic dimensions. Other workers probably would have called this leveling.

Other uses of the term *leveling* are as follows. Leveling is a decrease in surface roughness as measured by rms values from the Brush surface analyzer or profilometer.[12, 16, 17, 18] In these same references and others,[1, 19] leveling and *smoothing* are used synonymously. Leveling is removing elevations and filling in depressions,[19] or reducing projections and filling in scratches.[20] Weisberg[17] seemed to think of leveling as throwing power into small scratches, but Dale [21] pointed out that the Watts nickel bath had good microthrowing power into pores but zero leveling power according to Weisberg's results with the surface analyzer. DuRose *et al.*[18] suggested that leveling may be a throwing power phenomenon on a micro scale. According to Thomas,[22] leveling is the ability to produce deposits relatively thicker in small recesses and relatively thinner on small protrusions with an ultimate decrease in the depth or height of the small surface irregularities. Foulke and Kardos[23] plated in microgrooves and expressed microthrowing power by the ratio of the deposit thickness on the side of a groove to the thickness on the normal surface; according to these authors leveling as it is known commercially is the result of microthrow giving a thickness ratio exceeding 1.0. To Pinner,[8] leveling and microthrowing power are the same thing. Finally, Langford[13] defined leveling as an increase in luster over that of the basis metal; he used smoothing to denote an improvement in contour.

Another term used less frequently in the literature is *hiding power*. According to Ostrow and Nobel[20] this is the ability to hide (from the naked eye) buff marks and tiny scratches. They concluded that hiding power is a form of leveling since it can be evaluated with the surface analyzer, not by rms values, however, but by the frequency factor, which is a measure of the number of scratches per unit distance traversed by the surface analyzer.

The relation between leveling or smoothing and microthrowing power is important, particularly because various people have considered *brightening* action to be a microscopic effect which may involve microthrowing power and/or leveling. Such opinions as these are found: brightness is determined by "micro-roughness;"[19] improvement in luster is the result of effects on a micro scale and is unrelated to throwing power;[9] brightening and leveling are two distinct characteristics of a bath;[17] brightness is due primarily to leveling;[20] and brightening corresponds to a submicroscopic smoothing effect.[27]

Reinhard[1] distinguished between microthrow and leveling by choosing to use a standard cavity of microscopic dimensions in which the depth exceeded the width, whereas leveling, according to him, was illustrated by the work of Gardam[27] and Willson and DuRose[28] who used cavities in which the width was several times the depth. At first sight this distinction appears valid, but, to quote DuRose *et al.*,[18] "It has been shown[14, 29, 30, 31, 32] many times that the apparent throwing power into small crevices and recesses is frequently much greater than that exhibited in larger recesses although the ratio of width to depth may be the same." They went on to say, "This may be one bit of evidence for considering leveling a throwing power phenomenon."

Review of Experimental Work

Although microthrowing power and leveling have often been mentioned and discussed, actual experimental data are scarce, especially in regard to microthrowing power. This survey of experimental work will be confined to those papers which deal with deposition into pores and individual cavities. Nine pertinent references will be discussed: Meyer,[14] Graham *et al.*,[15] Dale,[21] Schaefer,[32] and Reinhard[1] obtained data on deposition into pores; Gardam,[27] Reinhard,[1] Leidheiser,[20] Schaefer,[33] Foulke and Kardos,[23] and Thomas[22] studied deposition in individual grooves or holes. The reference numbers will be omitted hereafter in this section.

Pores. The study of microthrowing power probably had its beginning in the work of Meyer in 1935 when he found that acid copper solution had the ability to deposit deep into a porous basis metal and that cyanide copper did not have this ability. Dale found that Watts nickel also had this ability. Graham *et al.* confirmed the results of Meyer with acid copper. Reinhard, using an ammonium-free dull nickel solution (Watts), showed that both the ability to deposit into pores and leveling increased with increasing metal content of the solution. Schaefer used sintered metal plaques of known porosity for his substrates and determined the effect of several variables on the degree of penetration by the deposit. The porosities of the powder compacts were determined statistically by non-wetting liquid media techniques. A variety of porosity ranges was obtained by using different types of powders. Penetration into the compact was determined by conventional metallographic procedures. Results important to this discussion are summarized in the following two statements. (1) The porosity of the original surface affected the degree of penetration although not in the same direction for all solutions. Decreased porosity of the original surface resulted in decreased penetration for Watts nickel, acid copper and cyanide silver, but increased penetration by Rochelle copper solution. (2) The effect of solution composition was shown in nickel baths where the order for degree of penetration was fluoborate > sulfamate > all sulfate > Watts, and the order for smoothness of deposits was Watts > fluoborate > sulfate > sulfamate.

Individual grooves or holes. Gardam used standard serrated cathodes in a study of the smoothing action of the unadulterated Watts nickel bath and with additions of zinc, cadmium, or iron. Reinhard systematically studied many of the variables listed above using, for the most part, three solutions: a dull nickel, a dull ammonium-free (Watts) nickel, and a bright nickel solution containing *p*-toluene sulfonylamide and zinc. His cavities were grooves cut with a razor blade in brass and were approximately 0.0012 in. wide and 0.0035 in. deep (0.030 × 0.090 mm). He expressed the microthrowing power as a thickness ratio: the ratio of the thickness of deposit in the groove at a point 0.001 in. below the surface to the thickness on the surface (see Fig. 1a). Instead of using grooves or scratches, Schaefer deposited from Watts nickel and cyanide silver solutions into drilled holes 0.0135 in. (0.343 mm) in diam. and varying in depth from 0.0312 to 0.254 in. (0.792 to 10.0 mm).

Leidheiser studied the leveling action of a Watts nickel bath and proprietary leveling and bright nickel baths. His cavity was a scratch on a wire 0.0031–0.0070 in. wide and 0.0039–0.0051 in. deep (0.08–0.18 × 0.10–0.13 mm). With these scratches he could not measure a thickness ratio, but he was able to follow the deposition process by photographing the profile at varying time intervals. From these pictures, information was obtained both as to the shape of the profile and as to the rate of scratch-filling. Using this standard cavity, he studied the effects of varying current density, *p*H, temperature, and addition agents, and also found a correlation between the cathode polarization caused by addition agents and the per cent decrease in depth of scratch. He also measured the effect of a variation in scratch size on the rate of scratch-filling.

Foulke and Kardos measured thickness ratios (ratio of thickness of deposit at the bottom of a groove to thickness on normal surface, or thickness halfway down to thickness on normal surface; see Fig. 1b) of deposits from a variety of nickel solutions and a few copper, silver and cadmium solutions. They also measured thickness ratios on micropeaks for a number of solutions. They used "record stampers and mothers" as a source of standard recesses and peaks. The grooves were mostly in the range 0.0027–0.0036 in. wide (0.068–0.091 mm) and 0.0012–0.0016

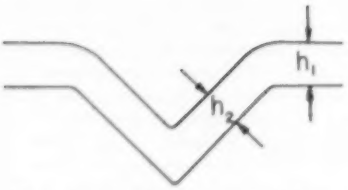


Fig. 1a.—Reinhard[1] measured h_2/h_1. h_2 was measured at a point 0.001 inch below original surface.

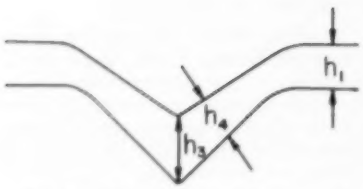


Fig. 1b.—Foulke and Kardos[23] measured h_3/h_1 and h_4/h_1. h_4 was measured at a point halfway down from original surface. Thomas[22] measured h_3/h_1 to obtain Figs 2 and 3.

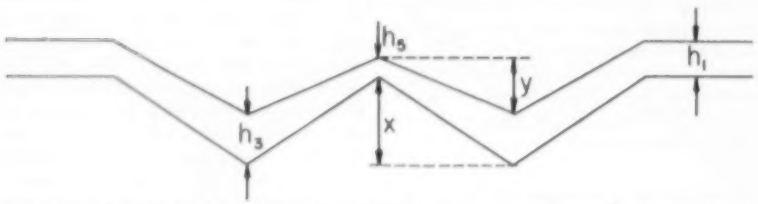


Fig. 1c. Roughness standard used by Thomas[22]. Leveling is expressed as (x — y) or h_2/h_5 (not the same as h_2/h_1).

Fig. 1.—Different methods used for the determination of the thickness ratio.

in. deep (0.030–0.041 mm). They measured thickness ratios and cathode polarization at varying current density, temperature, and with and without agitation, for the Watts bath and with additions of an acetylenic brightener, thiourea, cadmium, or magnesium. They also studied the effect of current density, agitation, and initial concentration on the rate of consumption of the acetylenic addition agent.

In the first part of his work Thomas studied the effect of depth and angle of groove on the thickness ratio (bottom to top; Fig. 1b) using a proprietary bright nickel solution. From the thickness measurements a per cent leveling (per cent decrease in depth) could be calculated. Thomas found that the per cent leveling values obtained by this method agreed well with the per cent leveling calculated from surface roughness measurements using the Surfindicator. He then measured surface roughness before and after plating on four commercially obtainable roughness standards differing in depth (68–1400 microinches, 0.0017–0.035 mm) but all with a 150° angle (Fig. 1c). The variables studied were groove direction, anode-cathode distance, *p*H, temperature, current density, agitation, metal concentration, and addition agents.

Variables which were shown to have little or no effect on microthrowing power and leveling in these studies are anode-cathode spacing and groove position (Reinhard, Thomas), and basis metal and solution resistivity (Reinhard). The other variables which have been studied may be divided roughly into three groups: factors relating to the solution, to the conditions of electrolysis, and to the cavities. These three groups are not entirely independent of each other, as will be seen later, but they comprise a convenient classification.

The Solution

Metal content. Reinhard found for the Watts nickel solution that increased metal content yielded higher thickness ratios up to a certain concentration. Watts nickel solutions containing 48 and 100 g/l of nickel gave practically the same thickness ratios, while those from a solution containing 16 g/l were considerably lower. Thomas found a definite increase in per cent leveling when the nickel content of a bright nickel solution was increased from about 40 to 80 g/l. For his deepest groove (0.0014 in.) this increase in metal content doubled the per cent leveling; in shallower grooves the effect was less pronounced. On the other hand, Foulke and Kardos found only a slight difference in thickness ratios from two Watts nickel solutions containing about 22 and 79 g/l. The concentration did, however, affect the relative cathode polarization for stirred and unstirred solutions.

Positive ions. Addition of 0.2–0.3 g/l of zinc, cadmium, or iron increased the smoothing action of the Watts bath (Gardam), and 0.2 g/l of cadmium also greatly increased the thickness ratio (see Fig. 1) in microrecesses (Foulke and Kardos). Large amounts of extraneous ions in the Watts bath such as sodium (Reinhard) or magnesium (Foulke and Kardos) decreased thickness ratios, the more so as the current density was increased. In the case of Reinhard's addition of Na_2SO_4, however, it is impossible to say how much of the effect was due to sodium and how much to the simultaneous decrease in nickel content. Thickness ratios were generally decreased by the use of ammonium chloride instead of nickel chloride (Reinhard).

Negative ions. The earlier observation of the good microthrowing power of acid copper solutions into pores as compared with cyanide solutions seems to hold for thickness ratios of deposits in grooves. This was shown by Reinhard who compared Rochelle-cyanide and acid copper solutions, and Foulke and Kardos who used a straight cyanide bath. Cyanide zinc gave poor thickness ratios compared with sulfate or chloride solutions (Reinhard). How much of this effect was due to cyanide ion *per se* is questionable, since the metal content in most of these experiments was considerably lower in the cyanide solutions than in the comparison solutions.

pH. Reinhard found no significant differences in thickness ratios for dull and bright nickel solutions at *p*H values of 3.5, 5.0 and 6.0, and Thomas found that *p*H had little or no effect on the leveling ability of a bright nickel bath (no range given). According to Leidheiser, *p*H does affect the rate of scratch-filling. He varied the *p*H of a semi-bright nickel bath from 1.5 to 4.0 and observed that the decrease in depth of scratch during a given time was greatest for the highest *p*H. However, a significant decrease in rate occurred only below a *p*H of 3.

Organic addition agents. Reinhard's results indicated that the agent in his bright nickel bath, *p*-toluene sulfonylamide, had little effect on thickness ratio although its presence was necessary for brightening of the deposit. The acetylenic brightener used by Foulke and Kardos had a marked effect, sometimes doubling or tripling the thickness ratio depending on operating conditions. Thiourea, according to these authors, either decreased or increased thickness ratios depending on the concentration of thiourea and current density. Thomas compared seven bright and one semi-bright proprietary nickel baths; the semi-bright gave somewhat better leveling than the others. The leveling action was definitely due to the addition of primary and secondary brighteners to the Watts bath since the Watts bath alone gave zero leveling by his method. Thomas also found that the organic addition agents did not cause any significant change in diffusion film thickness. According to Leidheiser's work, scratch-filling in the Watts bath occurs in time, but at a much slower rate than in the semi-bright bath. In one experiment, deposition from the Watts bath gave a 13 per cent decrease in depth while the semi-bright bath in the same time and under the same operating conditions gave an 85 per cent decrease in depth. More interesting was the difference

in the manner in which the scratch was filled; as deposition proceeded, the scratch in the semi-bright bath became wider. In order for this to have happened, deposition at the bottom of the scratch must have taken place at the expense of deposition along the sides. In the Watts bath no increase in width of scratch was observed; in narrow scratches the decrease in depth resulted from the inward growth along the sides of the scratch.

Foulke and Kardos investigated the rate of consumption of their acetylenic addition agent during deposition. The rate was independent of current density, directly proportional to initial concentration of addition agent, and approximately doubled by agitation. The rate of consumption of this particular agent, they concluded, was diffusion-controlled.

The effect of addition agents on cathode polarization in connection with leveling has been studied by Leidheiser and by Foulke and Kardos. Leidheiser measured the per cent decrease in scratch depth in the Watts and six other baths with addition agents giving a range of cathode polarizations. In the current density range 0.5–4.0 amp/sq dm (4.6–37 asf) the per cent decrease in depth in a given time was approximately directly proportional to cathode polarization: the best scratch-filling was obtained in baths yielding high cathode polarizations. The same relationship was obtained in another series of experiments employing the same addition agent (ethylene cyanohydrin) in all cases but varying the concentration in order to give a series of cathode polarization values.

Foulke and Kardos observed that the solutions containing agents which produced thickness ratios of greater than 1.00 also showed cathode polarizations which were greater for stirred than for unstirred solutions. With their acetylenic brightener, for example, polarization was greatly increased by stirring whereas in the pure Watts bath polarization was decreased by stirring. The relation between leveling action and polarization of stirred and unstirred solutions held for coumarin (a good leveler) and naphthalene 1, 3, 6-trisulfonate (a poor leveler). The effect of thiourea on the thickness ratio mentioned above was correlated with whether stirring increased or decreased polarization. The behavior of thiourea is particularly interesting in the light of the study by Roth and Leidheiser.[24] With increased concentration the potential increased (in most cases) or decreased depending on the compound, but of the 76 compounds studied, thiourea was the only one which first caused a decrease and then an increase in potential as the concentration increased. The minimum in the potential-concentration curve occurred at about 0.001 mole/l for a current density of 1 amp/dm² (9.29 asf).[25] This concentration agrees remarkably well with some data of Foulke and Kardos: from their potential-current density curves for three different thiourea concentrations it can be estimated (at a current density of 1 amp/dm²) that the concentration at which stirring began to increase instead of decrease the potential, was just about 0.001 mole/l. The fact that cathode polarization is dependent not only on solution composition but also on agitation is one indication of why the groups of variables cannot be separated from one another in practice.

Roth and Leidheiser[24] observed that agitation always had the same effect as increasing the concentration of the organic compound. In the case of compounds which increased the cathode potential in an unstirred solution, the increase in potential was dependent on the rate of stirring. In the case of compounds which had only a slight effect on the potential, the potential did not change upon agitation. In a later paper Leidheiser[10] observed that the compounds which had the greatest effect on the cathode potential were also the compounds which were most effective in enhancing the scratch-filling characteristics of the Watts bath. These experiments and those of Foulke and Kardos thus support one another. *The best scratch-filling agents are those in which slight changes in concentration have a large effect on the cathode potential.*

Operating Conditions

Current density. Reinhard, Leidheiser, and Foulke and Kardos all found that increasing the current density gave poorer microthrowing power and leveling, but Thomas got better leveling with higher current densities. Thomas' results agree with the majority of experiments on leveling according to Jernstedt.[16] In Thomas' work, both the final per cent leveling and the rate of leveling were greater at the higher current densities. His range was 10–50 asf (1.1–5.4 amp/dm²), the same as Reinhard's; Leidheiser's was 18–74 asf (2.0–8.0 amp/dm²), and Foulke and Kardos used 40 and 100 asf (4.3 and 10.8 amp/dm²). There were differences, of course, in operating conditions and solution composition, but the differences between Thomas and the others were no more profound than the differences among the other three. The only significant difference between Thomas' experiments and the others may have been the difference in size and shape of cavity.

Direct measurements of diffusion film thickness at varying current density were made by Thomas. The film thickness of a bright nickel solution was directly proportional to current density up to a thickness of about 0.16 mm (0.0062 in.) and 35 asf (3.8 amp/dm²) after which the thickness increased slowly to a maximum of about 0.20 mm (0.0078 in.) at 70 asf (7.6 amp/dm²).

Temperature. An increase in temperature from 25 to 40 C resulted in somewhat larger thickness ratios for Reinhard's dull nickel solutions but had no effect on his bright nickel. Thickness ratios were higher at 50 than at 25 C for the Watts plus acetylenic addition agent and Watts plus cadmium solutions of Foulke and Kardos, but the thickness ratio was lower at the higher temperature for the Watts plus thiourea solution. Over the range 10–60 C the rate of scratch filling of a semi-bright nickel bath increased with increasing temperature (Leidheiser). Thomas' bright nickel bath showed the best rate and per cent leveling at the lower (43.3 C) of three temperatures. At the two higher temperatures, 57.2 and 68.3 C, there was very little difference in leveling ability. The experiments of Leidheiser and Thomas are almost comparable since they both measured rates of leveling at very nearly the same current density (37.2 and 30 asf, respectively). Here again perhaps the only significant difference was in the size and shape of the groove.

The effect of temperature on diffusion film thickness of a bright nickel solution was measured by Thomas at 9 and at 37 asf over the range 16–50 C. In both cases the thickness decreased with increasing temperature, although the effect was less pronounced at the higher current density (greater film thickness).

It should be emphasized that the authors being considered here have not systematically investigated the effect of temperature on cathode polarization. Foulke and Kardos in some cases obtained their polarization data at two different temperatures; in all such cases, polarization values were lower at the higher temperature.

Agitation. In Reinhard's experiments, agitation had a minor effect on the thickness ratios obtained in the dull and bright nickel solutions, the ratio being slightly higher with agitation for the dull nickel and slightly lower for the bright nickel. However, Thomas found that agitation definitely improved leveling, both as to rate and as to final per cent leveling. The effect was most noticeable in the deepest groove. In a majority of Foulke and Kardos' experiments where a comparison is possible, agitation increased the thickness ratio, but, as was indicated above, the important question was not the effect of agitation itself, but whether agitation increased or decreased the cathode polarization. It bears restating that their qualitative rule was that if agitation increased the polarization for a particular solution at particular operating conditions, then the thickness ratio would be greater than 1.0.

Deposit thickness. Reinhard found that deposit thickness had a minor and irregular effect on thickness ratio in his dull and bright nickel solutions and in cyanide and acid copper solutions. From Leidheiser's graphs showing rate of scratch filling (depth vs. time) it can be seen that

the rate decreased and tended to level off after a time. The same result is shown by Thomas' data except that he plotted surface roughness against deposit thickness. Also, the initial rate and, in fact, the shape of the whole rate curve varied depending on groove dimensions and operating conditions. In other words, when per cent leveling values and thickness ratios are calculated, the values obtained depend on how much metal is deposited. Leidheiser found that the Watts bath filled a scratch apparently by uniform distribution (*cf.* DuRose *et al.*[16]). In such a case, thickness ratios should be independent of deposit thickness. If the scratch widens and the angle increases, then the per cent leveling, and perhaps also thickness ratio, would be expected to change as deposition goes on. As will be seen in the next section, cavity size and shape are definitely important factors affecting leveling and microthrowing power.

The Cavity

In one series of experiments with his bright nickel solution, Reinhard varied the groove depth from 0.001 to 0.0075 in. (0.025–0.19 mm) and found that the thickness ratio decreased somewhat for the deeper grooves. The angle of these grooves was approximately 19°. The holes plated by Schaefer from Watts nickel and silver cyanide solutions varied in depth. Roughly, the shorter the hole, the farther down the deposit went and the less thick it was at the top. These holes were about ten times as big both in depth and width as Reinhard's grooves. These results raise the question of whether microthrowing power should be thought of in terms of how far down the deposit goes or how thick it is at a given depth.

Leidheiser run two sets of experiments to determine the effect of varying depth and width on the rate of scratch filling. In the first set, four scratches of approximately the same depth (0.0039–0.0047 in., 0.10–0.11 mm) and varying width (0.0037 to 0.0070 in., 0.094–0.18 mm) were plated in a semi-bright bath, and the depths after various times of plating were determined. The calculated angles of these scratches were 43, 48, 53 and 84°. The narrower the original scratch, the more rapid was the initial rate of filling. In other words, for a given depth the initial rate of filling decreased as the angle increased. As deposition continued, the rate decreased as would be expected for the semi-bright bath in which the angle increased during deposition. In the second set of experiments, Leidheiser followed the process of scratch filling for four scratches with differing original depths of 0.0010, 0.0015, 0.0027 and 0.0039 in. (0.025–0.10 mm) and with widths approximately twice the depth (90° angle). The initial rate of filling was approximately the same for all the scratches.

Thomas made a test panel containing a series of V-shaped grooves varying in depth from 0 to 0.050 in. (1.3 mm) and with angles ranging from 45 to 167°. His results are shown in Figs. 2 and 3. The ratio of plate thickness in the root (T_r) to thickness on the adjacent flat surface (T_f) was plotted against groove depth in mils. It is obvious that both groove depth and angle had considerable influence on the thickness ratio, although there was no great difference for grooves less than about 0.002 in. (0.05 mm) deep. There is no indication in Thomas' paper as to how close the grooves were to each other on the test panel. That the number of grooves per unit area should have an effect on leveling was pointed out by Dunning.[30] Adjacent grooves have also been treated by DuRose *et al.*[16] Figs. 2 and 3 are evidence for the statement that not only the ratio of width to depth but also the actual size of a cavity affects leveling. The reason why the maximum leveling decreases for angles greater than 90° is presumably because metal distribution becomes more and more uniform until at 167° there is practically no leveling. In most of his experiments on the effect of current density, etc., on leveling, Thomas found that the leveling effect stopped at a given plate thickness, and measurements

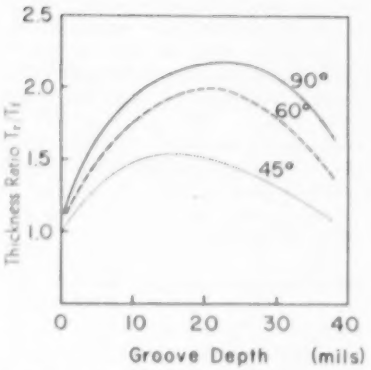


Fig. 2.—Effect of groove depth and angle on leveling. After Thomas.[22]

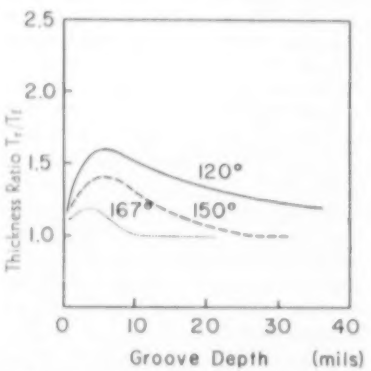


Fig. 3.—Effect of groove depth and angle on leveling. After Thomas.[22]

at this point showed the angle to be approximately 167°. So also, Leidheiser's rates of leveling declined after a time because the angle of the scratch increased. Curves like those in Figs. 2 and 3 would presumably differ for every solution and every set of operating conditions. Thomas could study with impunity the effects of temperature, etc., on the leveling ability of his bright nickel solution so long as he confined himself to grooves shallow enough so that the increasing angle made no difference. But it is questionable whether two solutions can be compared unless the effects of groove depth and angle are known for each, or whether the effects of variables can be compared unless the cavities are very nearly alike in size and shape. It should be pointed out that in curves such as those in Figs. 2 and 3 the positions of the maxima would probably, and the values of the thickness ratios would undoubtedly, vary with the deposit thickness.

Theoretical Review

Gardam,[31] Hoar and Agar,[32] and DuRose *et al.*,[16] to mention only three, have treated theoretically the current and metal distribution in the Haring-Blum cell,[26] the best known experimental device for measuring throwing power. This cell contains two cathodes, one at each end of a rectangular box, with the anode between them and closer to one cathode than to the other. The amount of metal deposited on each cathode is determined experimentally and the throwing power T is calculated[33] by

$$T = \frac{L - M}{L + M - 2} \times 100 \qquad (1)$$

where $L = l_f/l_n$ = distance from anode to "far" cathode / distance from anode to "near" cathode and $M = m_n/m_f$ = grams of metal deposited on "near" cathode / grams of metal deposited on "far" cathode

The metal ratio M is approximately equal to the current density ratio i_n/i_f. More exactly, $m_n/m_f = e_n/e_f \times i_n/i_f$, where e is the metal deposition efficiency. The current density ratio is given by equation (2):

$$\frac{i_f}{i_n} = \frac{I_n + \kappa\,(\Delta P/\Delta i)}{I_f + \kappa\,(\Delta P/\Delta i)} \qquad (2)$$

where $\Delta P = P_n - P_f$ = difference in polarization at near and far cathode,

$\Delta i = i_n - i_f$

κ = specific conductivity of the solution.

Gardam[31, 27] realized the theoretical possi-

bility of good throwing power into small recesses if equation (2) is thought of as applying to a scratch, for example, in which the bottom and the top of the scratch correspond to the "far" and "near" cathodes, respectively. Quoting Gardam,[27] "The path of the current from the anode to two closely adjacent points on a microscopically flat cathode may be regarded as pursuing a common path to a point near the cathode and then diverging; if the two points are very close together, a very small change of resistance in one path will divert a large proportion of the current to the other." Also, the distance between the cathode and the point of divergence can be considered to be the virtual anode-cathode distance. That is to say, if the two adjacent points on the cathode are very close together, l_f and l_n are small. Hour and Agar[29] showed that not only L but also the size of l_f and l_n affect the throwing power. From equation (2) it can be seen that if l_f and l_n are small, the polarization term will be the more important term affecting i_f/i_n. The most complete application of equation (2) to leveling was made by DuRose *et al.*[18] In order to have leveling, the current density at the bottom of the scratch must be equal to or preferably greater than at the top, that is, i_f/i_n must be equal to or greater than one (Δi negative). This is possible according to equation (2) if $\kappa\,(\Delta P/\Delta i)$ is negative and equal to or larger than one. In order for $\Delta P/\Delta i$ to be negative, ΔP must be positive. This is impossible with the usual polarization-current curve, but because of local phenomena such as hindrance to discharge of ions or incorporation of atoms into the lattice it might be possible for the polarization to be greater at the top of a scratch than at the bottom. DuRose *et al.* then expanded equation (2) to include the possibility that the static electrode potential for the cathode is not uniform over the entire surface, as was suggested by Dunning[30]:

$$\frac{i_f}{i_n} = \frac{l_n + \kappa\,(\Delta P/\Delta i) + \kappa\,(\Delta E/\Delta i)}{l_f + \kappa\,(\Delta P/\Delta i) + \kappa\,(\Delta E/\Delta i)} \qquad (3)$$

where $\Delta E = E_n - E_f$, and E is the static potential taken to be positive when resisting the flow of current. If the static potential is lower in the scratch than on the surface, the likelihood of having a current density ratio favorable to leveling is enhanced.

Another equation for i_f/i_n was obtained by DuRose *et al.* and is given in equation (4):

$$\frac{i_f}{i_n} = \frac{R_n\,(V - \Sigma E_f)}{R_f\,(V - \Sigma E_n)} \qquad (4)$$

In this equation V, the voltage drop from equipotential points in the solution to the cathode, is assumed to be the same for both circuits. R is a term including the specific resistance of the solution and the length of path. ΣE is a term including all factors relating to the potential of the specific cathode, such as static potential, concentration polarization, hindrance to discharge of ions by adsorbed matter, incorporation of atoms in the lattice, etc. It can be seen that if ΣE_n is sufficiently larger than ΣE_f it is quite possible for i_f/i_n to be larger than one. It may be noted from equation (4) that solution conductivity should have little or no effect on the current density ratio, and hence on thickness ratio, if the scratch is small enough. This was confirmed experimentally by Reinhard. DuRose *et al.* stressed that their equations are approximate and do not fully explain leveling. The equations do show, however, that leveling is theoretically possible and support the prevailing idea that leveling is due to local polarization phenomena.

DuRose *et al.* showed diagrams of typical deposit distributions resulting in positive, zero, and negative leveling (Fig. 4), and indicated that a certain amount of leveling can occur even with uniform metal distribution (Fig. 5) when leveling is expressed as decrease in depth or as a ratio of thickness at the bottom to thickness on the normal surface.

A diagram was also given showing the possible mechanism of leveling in closely adjacent scratches (Fig. 6). The deposit thickness on the flat surface between the grooves is seen to be less than on the normal flat surface. Thomas, whose roughness standards consisted of adjacent grooves, observed the effect shown in Fig. 6. In connection with the experimental results cited above, it is obvious that thickness ratio values depend, in part, on where the thickness is measured. Unfortunately, the thickness ratios measured by Reinhard,[1] Foulke and Kardos,[23] and Thomas[22] were all defined differently (see Fig. 1).

Many people including Gardam[27-37] and Schmellenmeier[38] have proposed that addition agents promote leveling by being adsorbed on the high points of the cathode, thus raising the deposition potential and lowering the current density on these points, and permitting relatively more deposition in depressions. Gardam[27] went on to point out that this mechanism would cause frequent and periodic variation of local current density which would account for the fine structure of parallel lines so characteristic of leveling deposits (see, for example, Foulke and Kardos' Fig. 3[23]). The polarization increase in the presence of sulfonates may be the result, Gardam postulated, of (a) the restriction of approach of nickel ions caused by the large addition agent ions or, more probably, (b) local increase of hydrogen overvoltage. The large molecules or ions of the addition agent may either obstruct the free access of nickel ions so that relatively more go to the low points, or may raise the electrical resistance of the cathode film at the high

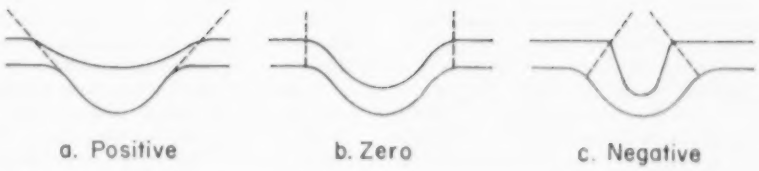


Fig. 4.—Three different ways in which metal may be electrodeposited around a scratch. After DuRose.[18]

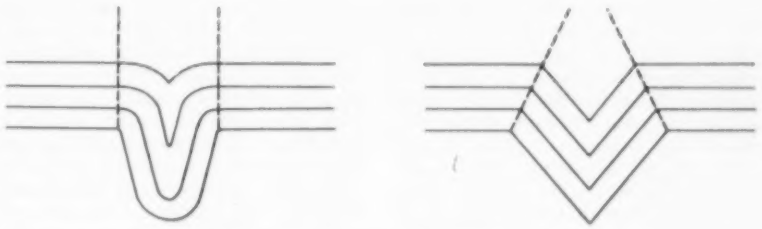


Fig. 5—Leveling with uniform metal distribution. After DuRose.[18]

Fig. 6.—Leveling in adjacent scratches. After DuRose.[18]

points in which case a large portion of the current is diverted to the depressions. His second possible explanation arises from evidence that the cathode potential of nickel deposition as a whole becomes more negative if the discharge potential of hydrogen is made more negative. The discharge potential of hydrogen is determined by the hydrogen ion concentration of the cathode film and by the hydrogen overvoltage of the cathode surface. An addition agent may affect the *p*H of the cathode film at the high points and also raise the hydrogen overvoltage. Thus the cathode potential may become more negative at the high points than at the low points. Roth and Leidheiser[34] also discussed the origin of the change in cathode potential due to addition agents. Their evidence supported the conclusion that the major cause is adsorption of the organic compound on the cathode surface, and that perhaps minor contributions are made by changes in cathode film *p*H, changes in concentration of nickel ions in the film due to complexing, and increase in ohmic resistance of the cathode film.

Ostrow and Nobel[35] believed that the most important factor in leveling is the relation between the deposition potential of the metal and the polarization at the cathode caused by the addition agent. Polarization causes the potential difference between the anode and the bottom of a scratch to be greater than the potential difference between the anode and the top of the scratch. If the difference between the two potentials is large compared with the deposition potential of the metal, a significant amount of leveling will take place. The ratio of the potential difference between the top and the bottom of the scratch to the deposition potential is large if the deposition potential is low. This is the case with acid copper solutions. With cyanide copper solutions, however, the deposition potential of copper is considerably higher, and so the potential difference between top and bottom, even if it is the same as in the acid copper solution, is small compared with the deposition potential. In order to make the ratio the same (and produce the same amount of leveling) in the cyanide solution as in the acid solution the factors making for potential difference between top and bottom (e.g., addition agents) would have to perform a greater function. These observations of Ostrow and Nobel are not an explanation, but they do provide an empirical rule which may prove useful. These authors went on to explain their results as to the effect of current density on leveling in acid copper solution. Both the deposition potential and the potential difference between top and bottom should increase with increasing current density, but the increase in potential difference is not as great as the increase in deposition potential. The ratio between the two and, therefore, the amount of leveling should thus decrease with increasing current density, as they found.

The basic assumption of Leidheiser's[20] theory of leveling in nickel solutions is that the nickel ions in solution reach the cathode by a path normal to the cathode surface and then the discharged atoms or undischarged ions migrate over the surface and become a part of the crystal with a slight preference for the lower regions of the surface. He preferred this process to one in which the nickel ions follow a path such that they are attracted to low regions and there discharged and incorporated into the crystal. Anything which interferes with making Ni-Ni bonds, such as the presence of foreign ions or molecules, reduces the local rate of plating. "The local rate of formation of Ni-Ni bonds is thus dependent upon competition between nickel ions and other materials in the bath for surface sites capable at that moment in time of making Ni-Ni bonds. If on arriving near a surface site the nickel ion loses the race for a vacant surface site, it must migrate over the surface or at a very short distance from the surface until it finds a vacancy. Considering the competition from the organic molecule only, the rate of migration and diffusion of an organic molecule into a microscopic recess will be less than the rate of migration or diffusion of nickel ions. Hence there will be a greater number of available surface sites in the recess and the rate of deposition, or rate of formation of Ni-Ni bonds, will be faster than on a neighboring surface. The net result of this competition is a leveling of the surface."

The fact that the ability of an organic compound to cause leveling is related to its ability to increase the cathode potential is in conformity with this theory. "The cathode potential may be considered a measure of the average energy required to convert a hydrated nickel ion in solution to a discharged atom occupying a stable position in the nickel lattice. In the presence of many organic compounds a barrier is erected at some state of the over-all process and it is thus necessary to furnish externally additional energy in the form of a greater impressed cathode voltage if a pre-determined current density is to be maintained. Since the ions have a range of energies, only those ions possessing the necessary minimum energy will be discharged. A certain number of ions, however, will have a greater energy than the necessary minimum and this energy can be released either by thermal oscillation or by migration over the surface. As this energy is dissipated, the atom will be trapped as a member of the lattice.

"As the average energy of the ions is raised, as is necessary, for example, when an organic compound is present in the bath, ions having greater individual energies will be produced. A certain fraction of the ions will be discharged with greater than the minimum energy. Although the fraction of ions having greater energies than the minimum should be approximately the same in the presence or absence of the organic compound, the absolute values of the energy will be greater in the presence of the agent. It is to be expected that a limited number of energetic ions will have available large amounts of excess energy which can be utilized in motion over the surface. The substance of the above considerations is that the greater the difference between the cathode potential in the Watts bath and the bath containing an organic compound, the greater the ability of the nickel atoms (or ions) to migrate over the surface."

This theory would account for some of the observations reported in the experimental section. A decrease in *p*H below three would significantly increase the amount of hydrogen deposited in nickel solutions, and the hydrogen would presumably interfere with the migration of nickel atoms. The rate of scratch filling would therefore be reduced as was found. Poorer leveling would be expected at higher current densities because the mean free path of each migrating atom would be reduced. The length of travel before the total dissipation of energy would thus decrease with increasing current density. On the other hand, a higher current density brings about a greater cathode polarization so that migration should be accelerated. The rate of scratch-filling would be expected to increase with temperature because migration and diffusion processes are generally accelerated by an increase in temperature. Leidheiser observed an increase in rate with temperature; Thomas[22] got a decrease. Here again, no clear-cut prediction can be made because polarization is affected by temperature, being either increased or decreased depending on the current density and the electrolyte.[41] Agitation would have two opposing effects: It would have the effect of increasing the concentration of addition agents[24] and raising the cathode potential, when a leveling agent is present, but should also increase the effective concentration of nickel ions by decreasing the thickness of the diffusion layer. The latter effect would tend to lower the potential. If there is a net increase in cathode potential upon agitation, leveling should be improved. This was found to be the case by Foulke and Kardos.[23] Finally, the depth and angle of scratch would presumably have an effect on migration and thus on leveling.

Current distribution theory[29, 32, 36, 42, 43, 44, 45] postulates uniform current distribution for sufficiently small microprofiles on the basis that the same polarization curve applies to the whole profile. A higher current density, then, at one point on the profile as compared to another point also produces a higher polarization. Foulke and Kardos[23, 24] compared the existent thickness ratio and polarization-current data with theoretical predictions from cur-

rent distribution theory and concluded that in order to explain both poor microthrow (thickness ratio less than one) and leveling (thickness ratio greater than one) it was necessary to assume that different polarization curves apply to the various points on a microprofile. That differences in crystal structure and surface curvature may influence local polarization had been considered before.[18, 20, 22, 46] Foulke and Kardos believed that microthrow and leveling can be essentially explained by the differences in polarization curves introduced by variation of the effective thickness of the diffusion layer over the microprofile. The significant difference between macro and micro surfaces is that the diffusion layer thickness is essentially constant on macro surfaces and can follow the contours, but when a recess is smaller than the effective thickness of the diffusion layer the layer cannot follow the contour. In other words, the effective thickness of the diffusion layer is larger for microrecesses than for micropeaks or for the normal surface. The rate of transport is given by equation (5):

$$\text{rate of transport} = k\,(C_b - C_e) \qquad (5)$$

where C_b is the concentration of the species under consideration in the bulk of the solution and C_e is its concentration at the electrode. k, the transport coefficient, depends on the thickness of the diffusion layer δ, as shown in equation (6).

$$k = D/\delta\,(1 - t) \qquad (6)$$

D is the diffusion coefficient and t is the transport number of the species. Combining the two equations,

$$\text{rate of transport} = \frac{D\,(C_b - C_e)}{\delta\,(1 - t)} \qquad (7)$$

From equation (7) it can be seen that if the thickness of the diffusion layer is larger for recesses than for peaks or normal surface, the rate of transport of all species will be less for recesses than for peaks. How much less depends on the species concerned and on the solution composition and operating conditions so that three possibilities can arise: (1) the polarization on the peak is the same as in the recess, or (2) it is greater in the recess than on the peak, or (3) it is greater on the peak than in the recess. Case (1) corresponds to zero leveling (thickness ratio = 1). When concentration polarization is small, for example in simple salt solutions operated well below the limiting current density, the thickness of the diffusion layer will have no effect on polarization. This case is represented by the experimental results with the Watts nickel bath. Case (2) corresponds to negative leveling (poor microthrow, thickness ratio less than 1). In this case concentration polarization is large, for example, in a simple salt solution operated near the limiting current density. Again the Watts bath is representative: thickness ratios decreased with increasing current density. Another example is the effect of cations such as magnesium ions on the thickness ratio. Such ions contribute to concentration polarization. Large concentration polarization is characteristic of complex cyanide solutions, and it is well known that they exhibit poor microthrowing power. In the absence of addition agents, according to this theory, the change of current distribution on microprofiles with increasing current density should be opposite to that for macroprofiles. This is because concentration polarization, which increases with increasing current density, throws the deposit into macrorecesses but out of microrecesses. The two opposite types of behavior are shown by cyanide solutions. The effect of increasing the current density should always be to decrease the microthrowing power if addition agents are absent. Case (3) results in positive leveling (good microthrow, thickness ratio greater than 1) and is due to the fact that the reduced transport of the addition agent to the recess as compared to the peak predominates over the reduced transport of the metal ion. The addition agent thereby increases the polarization at the peak to a greater extent than in the recess, current density is increased in the recess, and metal will deposit in the recess preferentially. The three cases were confirmed experimentally by Foulke and Kardos[22] by measuring the polarization in unagitated and agitated solutions. Since agitation decreases the effective thickness of the diffusion layer, the polarization curves when unagitated and agitated correspond (not exactly) to the polarization in the recess (larger δ) and on the peak (smaller δ). If agitation increases the polarization of a given solution at certain operating conditions, then that solution should produce leveling at those same conditions. Foulke and Kardos found that thickness ratios corresponded semi-quantitatively to the displacement of the polarization curve brought about by agitation. They also outlined the conditions which should be fulfilled to make this correspondence quantitative.

Kardos[21] was able to draw certain conclusions about the effect of size and shape of recesses on thickness ratios. Recesses having the same angle but different widths and depths would have the same δ_{recess} and δ_{peak} values, and therefore the same thickness ratios, provided that the widths are considerably smaller than δ. With the same thickness ratio, however, the smaller recesses would be filled more rapidly than the larger recesses. Thomas' curves[22] (Figs. 2 and 3) showed that thickness ratios were not the same for different depths although the variation was not large up to the approximate deposit thickness of 0.5 mil. Leidheiser's rates of filling[23] were the same for all depths. If the recesses have the same initial depth but varying width and angle, the ratio of δ_{recess} to δ_{peak} would be larger for the recesses with the smaller angle, and they would show better leveling than the wider recesses. This prediction is confirmed by Leidheiser's experiments and is contradicted by Thomas' curves in Fig. 2 but not in Fig. 3. The contradictions noted here between theory and experiment are probably related to the fact that the angle and width of a recess increases during deposition when leveling occurs. In general, Kardos' theory states that thickness ratio is dependent on the angle of the recess, and that both depth and angle will determine the effect of thickness ratio at a given deposit thickness on the resulting smoothness (RMS) of the surface.

Proposed Initial Experimental Work

The objective of Project No. 17 is to make a fundamental study of microthrowing power. It was agreed during the early discussions with the Research Committee that the experimental approach must be such that data on microthrowing power could be obtained from individual recesses rather than from average values from a composite surface.

The important decision that must be made next is, "What experimental technique will be used in the study?" Chief among the requirements of the technique is the ability to clean the internal surfaces of the microrecesses. Other requirements are the following: (1) The ability to see within the recess at the end of the experiment and to determine the deposit distribution therein. (2) The ability to perform more than one experiment at a time so that reproducibility of results can be conveniently determined. (3) The ability to change the size of the recess without changing its shape. With these thoughts in mind several different methods for obtaining the microrecesses are now being studied. No method yet attempted has proven entirely satisfactory but definite progress is being made.

In the early experiments answers will be sought to the following two questions:

(1) At approximately what size do considerations of microthrowing power and macrothrowing power merge in the acid copper and Watts nickel solutions?

(2) What are the effect of the variables on the microthrowing power of acid copper and Watts nickel solutions?

A decision on what further questions to ask will be determined largely by the answers to these two questions.

BIBLIOGRAPHY

[1] C. E. Reinhard, "Some Observations of the Microthrowing Power of Plating Solutions," Proc. Am. Electroplaters' Soc. **37**, 171–83 (1950).

[2] J. Kronsbein, "Current and Metal Distri-

bution in Electrodeposition. I. Critical Review of the Literature," Plating **37,** 851–4 (1950).

[3]W. Blum and G. B. Hogaboom, "Principles of Electroplating and Electroforming," McGraw-Hill, N. Y., 3rd ed., pp. 89–100 (1949).

[4]L. C. Pan, "The Computation of Throwing Efficiency," Trans. Am. Electrochemical Soc. **58,** 423–32 (1930).

[5]S. Field, "Some Aspects of Throwing Power—its Quantitative Expression," J. Electroplaters' and Depositors' Tech. Soc. **7,** 83–90 (1932).

[6]G. E. Gardam, "The Measurement of Throwing Power and the Prediction of Thickness Distribution," J. Electrodepositors' Tech. Soc. **25,** 77–81 (1950).

[7]G. E. Gardam, "Throwing Power of Electroplating Solutions," Metal Finishing **47,** No. 1, 55, 67 (1949).

[8]R. Pinner, "Introduction to Throwing Power and Covering Power in Electroplating Solutions," Electroplating **7,** 9–15, 49–53, 59 (1954).

[9]W. de Bruijn, "Throwing Power and Covering Power in Electroplating Solutions," J. Electrodepositors' Tech. Soc. **27,** 1–11 (1951).

[10]H. L. Farber and W. Blum, "Throwing Power in Chromium Plating," Bur. Standards J. Research **4,** 27–53 (1930).

[11]J. B. Mohler, "Cathode Efficiency as a Control Factor," Metal Finishing **52,** No. 11, 91–2 (1954).

[12]J. E. Stareck, F. Passal, and H. Mahlstedt, "Self-Regulating High-Speed Chromium Plating," Proc. Am. Electroplaters' Soc. **37,** 31–47 (1950).

[13]K. E. Langford, "Leveling in Bright Nickel Plating Solutions," Electroplating and Metal Finishing **9,** 39–43, 48, 71–6 (1956).

[14]W. R. Meyer, "The Orientive Effects of the Geometrical and Crystalline Structure of Electrodeposits," Proc. Am. Electroplaters' Soc. **24,** 123–139 (1936); cf. ibid. **37,** 213 (1950) (discussion).

[15]A. K. Graham, H. L. Pinkerton, E. A. Anderson, and C. E. Reinhard, "Plating of Pressed Metal Powder Parts," Plating **36,** 709–9 (1949).

[16]G. W. Jernstedt, "Leveling with Periodic Reverse Current Plating," Proc. Am. Electroplaters' Soc. **37,** 151–67 (1950).

[17]L. Weisberg, "Leveling in Cobalt-Nickel Plating Solutions," Proc. Am. Electroplaters' Soc. **37,** 185–91 (1950).

[18]A. H. DuRose, W. P. Karash, and K. S. Willson, "Surface Contour and Leveling," Proc. Am. Electroplaters' Soc. **37,** 193–212 (1950).

[19]C. L. Faust, "Smoothing by Electropolishing and Chemical Polishing," Proc. Am. Electroplaters' Soc. **37,** 137–50 (1950).

[20]H. Leidheiser, Jr., "The Mechanism of Leveling during the Electrodeposition of Nickel in the Presence of Organic Compounds," Z. Elektrochem. **59,** 756–65 (1955).

[21]J. J. Dale, Proc. Am. Electroplaters' Soc. **37,** 191, 215 (1950) (discussion).

[22]J. D. Thomas, "Leveling. Definition, Measurement, and Understanding," Proc. Am. Electroplaters' Soc. **43,** 60 (1956).

[23]D. G. Foulke and O. Kardos, "Current Distribution on Microprofiles. I," Proc. Am. Electroplaters' Soc. **43,** 172 (1956).

[24]O. Kardos, "Current Distribution on Microprofiles. II," Proc. Am. Electroplaters' Soc. **43,** 181 (1956).

[25]B. D. Ostrow and F. I. Nobel, "A Study of Leveling in Cyanide Copper Baths," Plating **41,** 885–91 (1954).

[26]K. M. Gorbunova, T. V. Ivanovskaya, and N. A. Shishakov, "Structure and Mechanism of Formation of Glossy Electrolytic Deposits," Zhur. Fiz. Khim. **25,** 981–7 (1951).

[27]G. E. Gardam, "Smoothing Action as a Mechanism in Bright Nickel Plating," J. Electrodepositors' Tech. Soc. **22,** 155–68 (1947).

[28]K. S. Willson and A. H. DuRose, "Smoothing Effects of Nickel Deposits," Plating **36,** 246–51, 275 (1949).

[29]J. N. Agar and T. P. Hoar, "Influence of Change of Size in Electrochemical Systems," Discussions Faraday Soc. No. **1,** 158–62 (1947).

[30]W. J. Dunning, Discussions Faraday Soc. No. **1,** 196–7 (1947) (discussion).

[31]G. E. Gardam, "Evaluation of Throwing Power in Electrodeposition," Trans. Faraday Soc. **34,** 698–711 (1938).

[32]C. Kasper, "The Theory of the Potential and the Technical Practice of Electrodeposition. III. Linear Polarization on some Line-Plane Systems," Trans. Electrochem. Soc. **78,** 131–47 (1940).

[33]R. Schaefer, unpublished data.

[34]C. C. Roth and H. Leidheiser, Jr., "The Interaction of Organic Compounds with the Surface during the Electrodeposition of Nickel," J. Electrochem. Soc. **100,** 553–65 (1953).

[35]C. C. Roth and H. Leidheiser, Jr., unpublished data.

[36]H. E. Haring and W. Blum, "Current Distribution and Throwing Power in Electrodeposition," Trans. Am. Electrochem. Soc. **44,** 313–45 (1923).

[37]G. E. Gardam, "Brightening Action of Organic Sulfonates in Bright Metal Plating," Proc. Third Intern. Electrodeposition Conf. 1947, 203–7.

[38]H. Schmellenmeier, "Smear Effect in the Electrolytic Deposition of Metals," Korrosion u. Metallschutz **21,** 9–11 (1945).

[39]T. P. Hoar and J. N. Agar, "Factors in Throwing Power Illustrated by Potential-Current Diagrams," Discussions Faraday Soc. No. **1,** 162–8 (1947).

[40]B. D. Ostrow and F. I. Nobel, "A Study of Leveling in Acid Copper Baths," Plating **41,** 892–99 (1954).

[41]F. W. Salt, "Overvoltage in Metal Deposition and Dissolution. I. Nickel," Discussions Faraday Soc. No. **1,** 169–81 (1947).

[42]C. Kasper, "Current Distribution in Electrodeposition," Monthly Rev. Am. Electroplaters' Soc. **26,** 11–26, 91–109 (1939).

[43]C. Wagner, "Theoretical Analysis of the Current Density Distribution in Electrolytic Cells," J. Electrochem. Soc. **98,** 116–28 (1951).

[44]C. Wagner, "Theory of Electropolishing," J. Electrochem. Soc. **101,** 225–8 (1954).

[45]J. Kronsbein, "Current and Metal Distribution in Electrodeposition. III. Experimental Determination of Metal Distribution," Plating **40,** 898–900 (1953).

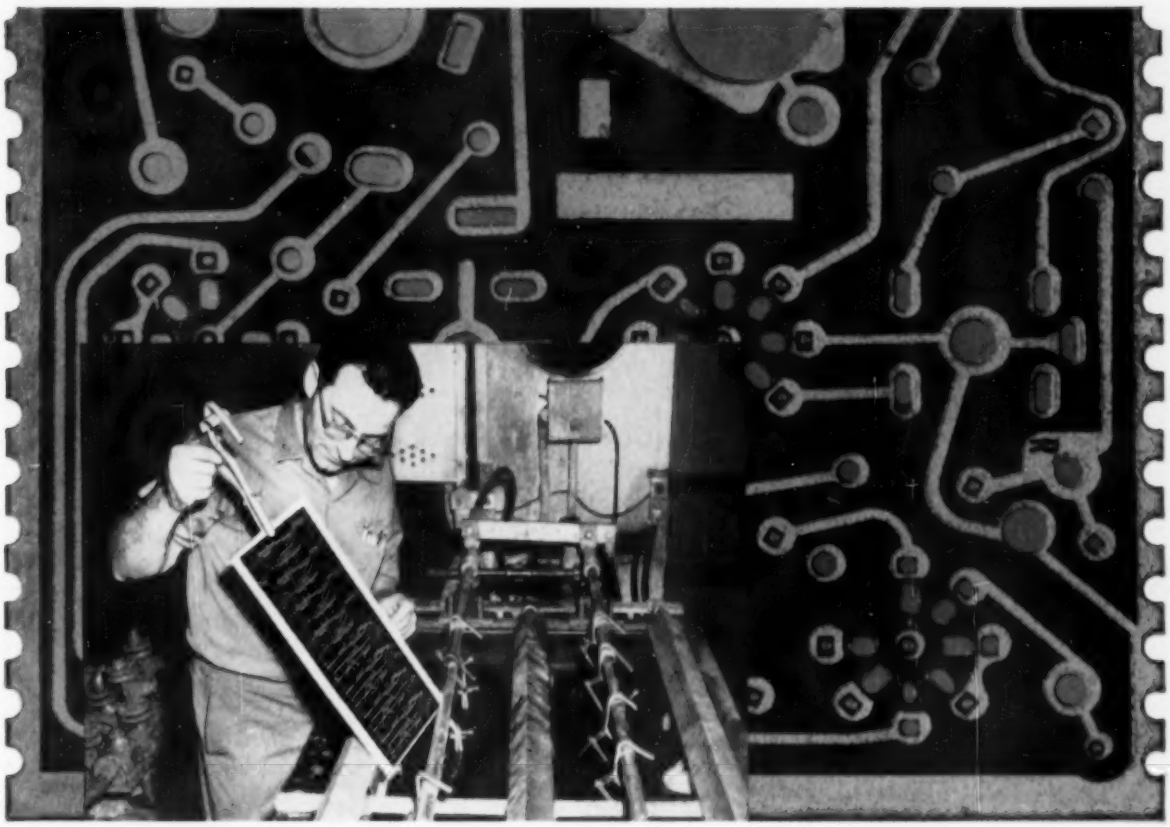
[46]S. I. Krichmar, "Effects of the Microprofile Surface Curvature upon Electrochemical Metal Polishing," Doklady Akad. Nauk S. S. S. R. **101,** 297–300 (1955).

Dr. Henry Leidheiser Jr. obtained his BS (1941), MS (1943), and PhD (1946), degrees from the University of Virginia. He is active in the Virginia Academy of Science, the Virginia Section of the American Chemical Society, and as an abstractor for Chemical Abstracts. He is also a member of Sigma Xi, the Electrochemical Society and the Raven Society (local at University of Va.)

Dr. Leidheiser is assistant director and a research supervisor at the Virginia Institute for Scientific Research, Richmond, Virginia.

Ester B. Leffler received her BS in chemistry from Pennsylvania State University in 1945, and a PhD from the University of Virginia in 1950. She was an instructor in chemistry at Randolph-Macon Woman's College from 1949 to 1953. Since then, Miss Leffler has been at Sweet Briar College where she is assistant professor of chemistry and chairman of the department.

A physical chemist, her research has consisted of the application of physical chemistry to problems of medicinal chemistry.



HOW TO PLATE PRINTED CIRCUITS

FASTER, BETTER, AT LOWER COST

...with B&A Fluoborates

First step—use B&A copper fluoborate for high-speed copper plating of thick, high quality circuits.

Second step—use B&A lead-tin fluoborate for maximum solderability (60:40 tin-lead deposit).

Advantages: Both of these high purity fluoborate plating solutions come in concentrated solution form. They give you easy bath make-up and easy control. Since anode and cathode efficiencies approximate 100%, you get easy maintenance, too. They require no mixing or dissolving, and offer excellent bath stability, good anode corrosion.

Result: You produce *better* printed circuits, *faster* and *at lower cost—more easily*, too!

Mail coupon now for comprehensive technical bulletins giving complete information on these improved plating techniques for printed circuits.

BAKER & ADAMSON®
Fine Chemicals
GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

BAKER & ADAMSON PRODUCTS
GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Please send technical bulletins on the use of B&A Fluoborates in the production of printed circuits.

Name _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____ PL-4

Available for Immediate Shipment, Attractive Values

The following excellent rebuilt and guaranteed electroplating motor generator sets and rectifiers, with full control equipment:

PLATERS

1—8000/4000 AMPERE, 6/12 VOLT, **CHANDEYSSON,** Synch.

1—7500/3750 AMPERE, 9/18 VOLT, **HANSON-VAN WINKLE-MUNNING,** Synchronous.

1—6000/3000 AMPERE, 6/12 VOLT, Electric Products, Synch.

1—5000/2500 AMPERE, 9/18 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.

1—4000/2000 AMPERE, 6/12 VOLT, **H-VW-M,** Synch., Exc.-in-head.

4—3000/1500 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Exciter-in-head.

1—2563/1250 AMPERE, 9/18 VOLT, **ELECTRIC PRODUCTS,** Synchronous, Exciter-in-head, 25°C.

1—2000/1000 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING.**

1—1500/750 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.

ANODIZERS

1—1000 AMPERE, 40 VOLT, **CHANDEYSSON,** 25° C.

1—1000 AMPERE, 30 VOLT, **IDEAL,** Exciter-in-head.

1—750 AMPERE, 60 VOLT, **HANSON-VAN WINKLE-MUNNING,** Synchronous, Exciter-in-head.

1—500 AMPERE, 25 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.

4—400 AMPERE, 40 VOLT, Separately Excited.

RECTIFIERS

1—2000/1000 AMPERE, 6/12 VOLT, **G. E.**

1—**GREEN SELECTOPLATER,** 1800 AMPERE, 12 VOLT, 220/3/60.

1—SEL-REX SELENIUM, 1200 AMPS, 9V, for 440/3/60.

1—1500/750 AMPERE 6/12 VOLT, UDYLITE-MALLORY

4—1440/720 AMPERE, 6/12 VOLT, UDYLITE-MALLORY

1—750 AMPERE, 12 VOLT, SELF-CONTAINED SELENIUM, UDYLITE-MALLORY.

SPECIAL

2—CROWN & H-VW-M Centrifugal Driers No. 1 and No. 2 with Heat.

1—H-VW-M Full-Automatic Plating Machine, 82' long, 39" lift, was used for chrome.

1—UDYLITE Semi-automatic Plating-Machine, for cyanide, size 19' long x 48" wide x 36" deep.

2—**RONCI** Enamelers, No. R-100 and No. R-200.

1—**ALMCO** DB8 Deburring Barrel, 2 Comp. Vari Drive.

1—ALMCO DB-2 Deburring Bbl, lined.

Above is partial list only. Write to us for all your requirements for Plating, Anodizing and Metal Finishing

WIRE—PHONE—WRITE

M. E. BAKER CO.

25 WHEELER STREET

Kirkland 7-5460 CAMBRIDGE 38, MASS.

BOOKS

(Continued from page 378)

less than comforting feeling that ". . . positive conclusions . . . to provide a basis for prediction about the behavior of new alloys, or old alloys in new environments, are still lacking."

Illustrative of some of the uncertainties that seem to exist regarding a generalized theory on stress corrosion cracking is a statement made by one author to the effect that ". . . it may well be that this (a general theory of stress corrosion cracking) is a vain hope . . .". This author then goes on to theorize that chemical (or electrochemical) attack can not account for the rapidity of failure observed in some tests, as for example—1 hour to crack a tensile specimen .1685 in. in diameter, and that the chief cause must therefore be physical. Yet this theory is also subjected to criticism because often such cracking can be stopped by chemical means.

Most authors, however, agree that stress corrosion cracking is due to the combined effects of stress, which may be externally applied, or may be residual stress, and a corrosive environment, although experimental evidence suggests that, at least in the case of aluminum-zinc alloys, a corrosive environment is not entirely necessary. A particularly lucid exposition of this phenomenon is made by T. P. Hoar and co-workers, who submit the following general conclusions. The mechanism of stress corrosion cracking of austenitic stainless steel is completely electrochemical in nature. Aluminum-magnesium and aluminum-copper alloys require the combined effect of mechanical and electrochemical action, while aluminum-zinc alloys can fail entirely by a mechanical mechanism. With respect to stainless steels, these authors advance such practical considerations that there is no threshold of applied stress below which stress corrosion cracking will never occur, nor do changes in composition offer any real relief. As for prevention of stress corrosion cracking in such steels, they feel that cathodic protection appears as a possible, if not, the only practical solution.

While most authors of this symposium stress the practical point of view, there are several papers which present highly mathematical treatments on the Structure of Grain Boundaries and on the role of Boundary Adsorption in stress corrosion cracking, as well as on thermodynamic considerations of Structural Factors. The Role of Hydrogen in stress corrosion cracking of steel is also treated from the theoretical point of view. U. R. Evans, on the other hand, presents a very readable exposition on the role of atomic hydrogen in stress corrosion cracking of carbon steels, inclusive of the effects in alkaline and cyanide solutions.

The last paper surveys the general field of stress corrosion cracking and the techniques employed in the laboratory for studying this phenomenon. It also includes a very ingenious classification of the several types of stress corrosion cracking.

From the above it is quite evident that the problem of stress corrosion cracking is far from being solved. Much work certainly still lies ahead. This collection of symposium papers may be considered merely as a progress report on the current status of the search for an eventual final answer. Anyone who is concerned with stress corrosion (and who can afford not to be) will find the material treated in this volume highly informative. While some of the papers may not appear to be easy to read, particularly to those not versed in the theoretical aspects of this problem, there is sufficient substance in most papers to make this volume a worthwhile addition to anyone's technical library.

Symposium on Properties, Tests, and Performance of Electrodeposited Metallic Coatings. Special Technical Publication 197, American Society of Testing Materials, Heavy Paper Cover, 129 Pages, $3.00; AES members $2.70.

The extensive use of plated metals, particularly electrodeposited, makes this Symposium of interest to engineers and scientists concerned with plating problems.

The volume is extensively illustrated and contains comprehensive tabular data. Prepared under the auspices of ASTM Committee B-8 on Electrodeposited Metallic Coatings, the Symposium contains the following significant papers:

Introductory Remarks by W. L. Pinner

History of ASTM Committee B-8 by William Blum

The Corrosion Behavior and Protective Value of Copper-Nickel-Chromium and Nickel-Chromium Coatings on Steel by C. H. Sample

Evaluation of Methods Available for Measurement of Surface Luster of Electroplated Coatings by G. B. Bowman

Recommended Practices for Cleaning Prior to Electroplating by S. Spring

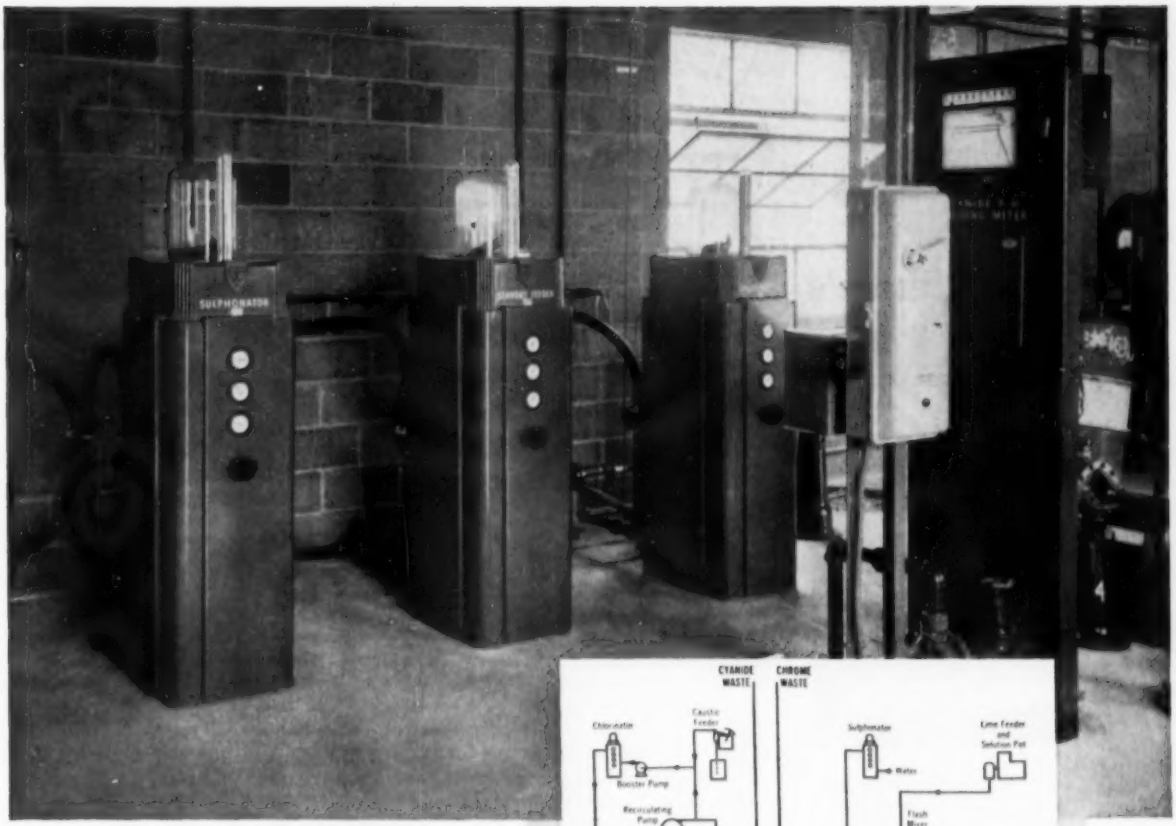
A Comparison of the Corrosion Behavior and Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel by C. H. Sample, A. Mendizza, and R. B. Teel

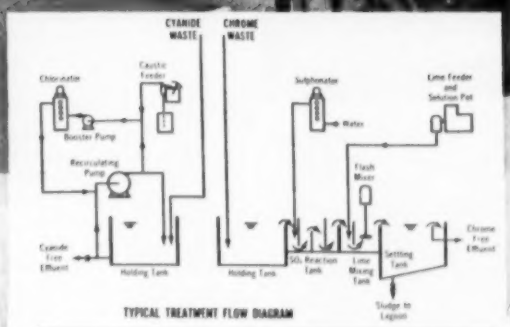
Evaluation of Phosphate Coating over Electrodeposited Zinc by A. L. Alexander

Evaluation of Testing Methods for Supplementary Coatings by R. E. Harr

Atmospheric Exposure of Electroplated Lead Coatings on Steel by A. H. DuRose

The Standard Salt-Spray Test—Is It a Valid Acceptance Test? by A. Mendizza





TYPICAL TREATMENT FLOW DIAGRAM

DAYSTROM INSTRUMENT DIVISION USES

W&T *Cyanide & Chrome Waste Treatment*

The Daystrom Instrument Division of Daystrom, Incorporated, located at Archbald, Pennsylvania, has provided a compact and efficient treating plant to destroy the toxic components of their plating waste. The treatment plant has been in continuous operation since 1953.

The cyanide bearing waste is treated with chlorine and caustic, using a W&T Water Diaphragm Chlorinator and a W&T Chemical Solution Feeder. The treatment breaks down the cyanide to harmless carbon dioxide and nitrogen gas components.

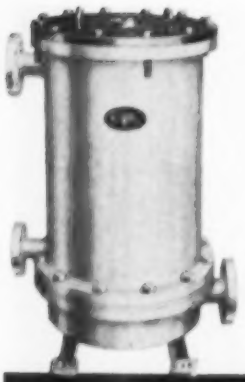
The chromium bearing waste is treated with sulphur dioxide and lime, using a W&T Sulphonator and a W&T Dry Chemical Feeder. The treatment removes the toxic chromium and other heavy metals from solution, to be disposed of as sludge.

If you would like more information on Wallace & Tiernan cyanide or chromium waste treatment, write for bulletin RA-2120-CP.

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

I-52



there's a

Fulflo FILTER

to meet YOUR EXACT NEEDS For Continuous Micronic Clarity

Fulflo Filters give you the exact degree of micronic clarity you need — for any size plating tanks, for high or low *pH* solutions, for any desired frequency of cycle. You minimize costly rejects. And you save on labor costs because Fulflo requires no filter aids — no cakes, plates or screens. Fulflo operates for weeks at a time without maintenance labor.

Whatever size plating tanks you use, you can filter them *completely and continuously* every hour, every half-hour, or even faster. Compact size allows for installation on individual tanks — even where space is limited. Genuine Honeycomb Filter Tubes are made from cotton to resist alkaline solutions, dynel for acids. Steel containers are resistant to alkaline solutions; for acids, stainless steel or rubber-lined steel is available.

Commercial Filters engineers are ready to help you with any problems involving micro-fine filtration of plating solutions. Write for technical literature to Department PL.

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

400 INDICATE A 429.

MAIL BOX—

DEAR SIR:

I am writing in regard to your article on the effects and removal of calcium from nickel plating solution. (February 1957, page 187)

Calcium is in my opinion the greatest single cause of rough nickel and unpredictable corrosion causer on bright plate.

Calcium roughness on steel can cut corrosion life very drastically. Bumper parts plated in a seeded bath to .0015 in. nickel rusted on those areas receptive to the roughness in a week of bad fall weather. Other areas remained like new.

All nickel solutions in hard water areas run at saturation and some precipitate is always present. Most platers avoid trouble, they think, by making water additions at the end of a shift to keep temperatures in the 125 to 135 F range by holding agitation at a low rate or going extreme as they can. By plating thin deposits and not stirring the tank, the effect can be minimized. Most platers have recurrent roughness. They start to investigate the problem and it goes away. The next day, week, or month they have it again. Hours or days later the situation has rectified itself and life goes back to normal until the next attack.

This roughness is due to calcium carried into the solution by water additions. Even freshly filtered solutions are not immune. Platers who run high production solutions are particularly susceptible to this problem; high chloride 15 to 25 oz/gal, high temperatures 145 to 160 F, or continuous operation.

I battled this condition for years and no longer plead guilty to tolerating it.

Here at Checker Cab we carry ½ to 1 oz/gal of nickel fluoborate in solution at all times. Calcium is almost instantly precipitated and removed by constant filtration. The fluoborate is replaced by estimation based on the amount of calcium carried into the bath by water addition.

At a former place of employment we were operating three shifts a day and the problem was a continuous hazard. We stripped whole tank loads of work because of it.

Our nickel supplier was at a loss to explain the nature or cause of the problem. Cleaner people were called in, and the problem always ended back in the nickel. All standard procedures were tried without effect. The roughness seemed not to follow any predictable pattern and we never knew when to expect it.

Finally the supplier told me that burning at the high current density areas was causing the trouble though there was no visible evidence of burning. By this time I was blaming my troubles on water-borne materials. We did not agree. It was suggested that addition of 2 oz/gal of nickel fluoborate would minimize burning. I agreed to try it.

The material was added to a 3000 gal solution. The bath worked swell for two hours, then parts began to look as if covered with flour. We could neither filter nor plate in the solution for three days. The parts were hazy, hard and impossible to buff due to a very fine roughness.

The solution was pumped into the storage tank, 200 lb of filter aid added and stirred for four hours. It was permitted to settle over night and then filtered back into the plating tank. The work was good, full bright and satin smooth. Not a trace of rough particles and it stayed that way for weeks. We used constant filtration before and after this happened. A sample was filtered separately, more nickel fluoborate added to it, then filtered. No precipitate was apparent. The solution was boiled and the water replaced with distilled water and then refiltered. No precipitate was obtained.

A duplicate solution was taken and given the same treatment except that tap water was used. A slimy white precipitate was retained on the filter. The paper was ashed and weighed. The amount of calcium introduced was calculated from the water analysis and recovery was quantitative. The material was identified to be calcium.

Addition of sodium and potassium fluoride had very little effect. Hydrofluoric acid was not satisfactory. Ammonium bifluoride has been suggested as an addition during filtering, but I haven't had the success with it I expected.

I've been using nickel fluoborate ever since to remove calcium. We keep about ½ to 1 oz/gal in solution at all times and replenish the solution whenever we feel it is depleted, using our average daily water replacement as a guide.

Lime can safely be used to raise the *pH* during batch filtration without fear of calcium contamination, avoiding the difficulty with the low solubility of nickel carbonate. Care should be exercised in quantity. It's easy to go too high.

I hope you find this useful.

MELVIN TIPPMAN, Plating Dept.
Checker Cab Mfg. Corp., Kalamazoo, Mich.

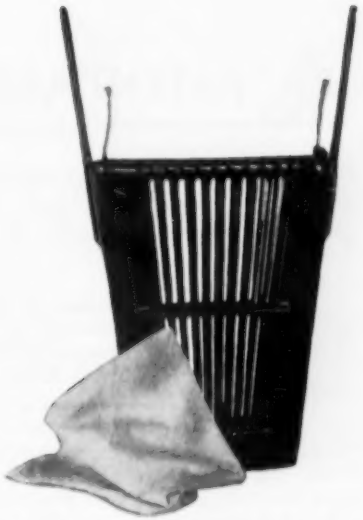
REPLY TO MR. TIPPMAN:

Mr. Tippman offers a method we are not familiar with. We had heard a casual observation made on precipitation of calcium as the fluoride and attempted direct removal with hydrofluoric acid which we pointed out was not effective. Not a great deal is known of the fluoborates and little has been published on the solubilities either in acid and alkaline solutions. It is therefore of particular interest that Mr. Tippman has found a selective precipitation of calcium fluoborate in acid solutions. This reaction appears worthy of study.

AUSTEN J. SMITH, Head
Michigan State University

SAVINGS

Most users report more than HALF THE COST of Forcite Anode Baskets is amortised IN THE FIRST Load by saving RE-CASTING COST!



FORCITE STANDARD SERIES—from 18 to 30" long.

FORCITE—THE NEW SYSTEM THAT PERMITS THE USE OF SMALL ANODE PARTICLES WHERE HERETOFORE IMPRACTICAL . . .

Users of the Forcite Basket System have quickly discovered that total conversion throughout their plating operations is highly profitable. Specifically, not only does the system permit use of small anode particles, with important savings but also additional economies such as:

1. Greater anode area
2. Smoother deposits
3. Permit large loads
4. Use of lower cost material
5. Complete solution of anode material

WHEREVER USED SAVINGS DEFINITELY PROVE THE POINT...

Typical recent reorders give convincing testimony to how important the Forcite Anode Basket System can be to your plating operations:

IN OHIO—Plant using 42 - 48" baskets.

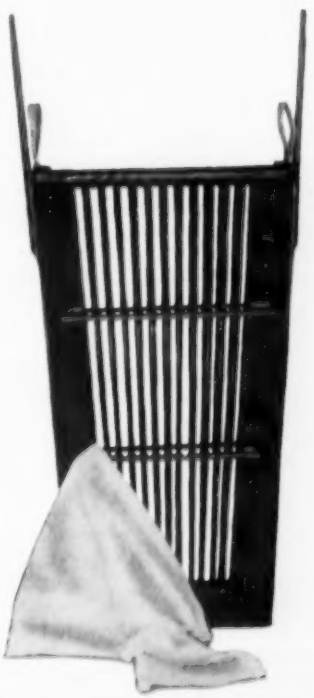
IN NEW YORK—Plant acquired a total of 20 baskets in lots of 4 to 6 over a period of six months.

IN MICHIGAN—Conversion half completed with 44 - 48" Series "15" baskets.

IN OHIO—Manufacturer tried 10 - 24" baskets and then ordered 30 additional.

IN MICHIGAN—After six months trial of 6 - 36" Series "15" baskets, ordered 70 - 36" baskets and 70 - 74" baskets as first stage of their conversion.

RESULTS SUCH AS THESE surely warrant your prompt consideration as to the savings that you too can make! Write us for name of your nearest distributor. . . .



FORCITE SERIES "15"—expressly designed for continuous rows—from 36" to 72" long.

FORCITE CORPORATION

31450 Shaker Blvd. • Chagrin Falls, Ohio

PATENT ABSTRACTS

DR. D. GARDNER FOULKE
Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co
Matawan, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,762,733, September 11, 1956—Composition for Forming Black Coatings for Metal—P. Borghetti and W. Cavanaugh, assignors to Parker Rust Proof Co., Detroit, Mich.

For steel, iron, nickel and nickel-iron alloys an aqueous solution is used consisting of: 5–100 g/l of phosphate ion, at least about 1 per cent of a first metallic ion from the group Zn, Mn, and Cd, said first ion being present in sufficient amount to form a phosphate with the major portion of the phosphate ion, about 0.0006 to 0.012 per cent of sulfide ion along with a second metallic ion which forms a black sulfide but will not oxidize the ferrous ion in the aqueous acidic solution.

6 claims.

No. 2,762,762, September 11, 1956—Method for Electroforming a Copper Article—D. Donahue, assignor to Radio Corporation of America, Del.

This method consists of maintaining the chloride ion content of a copper sulfate bath between 0.025 to 0.045 g/l then plating on a more noble metal such as Pd, Pt, or Au. This chloride content makes for good separation of the copper electroform from the basis metal. The bath given is:

$CuSO_4$	100–250 g/l
H_2SO_4	to adjust to pH 1.5 to 2.0
Chloride ion	0.025–0.045 g/l

4 claims.

No. 2,762,764, September 11, 1956—Method for Electroplating Aluminum—C. Diven, assignor to United States Steel Corp., N. J.

An anhydrous salt electrolyte for plating aluminum at at least 400 F consists of:

	Per cent.
Aluminum chloride	60–90
Alkali metal chloride	9.5 to 39.5
Alkali metal fluoride	0.5 to 7.0

8 claims.

No. 2,762,766, September 11, 1956—Electrolytic Polishing Solution—Bo-Shin Ro, assignor to Khi-Beng Choing, San Diego, California.

This method consists of contacting the steel with a solution of 100 parts concentrated nitric acid (sgl 52), 4 parts hydrofluoric acid (not less than 507 HF) and 2 parts potassium dichromate and passing a current of 120 amp/sq dcm and 10 for 60 v sec. The temperature is 15 C.

3 claims.

No. 2,762,772, September 11, 1956—Contact for Electroplating Machines—William Jackson, assignor to Udylite Corp., Detroit, Mich.

The single claim states: "In an electroplating machine for electroplating articles in bulk having a perforated barrel rotatably supported at each end for supporting the articles in the plating bath during the plating operation, a flexible cathode lead fixed at one end and projecting into the barrel through an end thereof at its axis of rotation, said flexible cathode lead having an insulating cover terminating short of the end thereof, a free moving uninsulated cathode contact knob at the end of the cathode lead for electrical contact with the articles being plated, and an arc preventer in the form of a length of flexible link chain secured substantially at its center with electrical conducting relation to said cathode knob to provide a plurality of cathode contact points on both sides of said contact knob whereby said knob makes continuous electrical contact with the articles being plated during its movement among said articles."

1 claim, 4 figures.

No. 2,771,411, November 20, 1956—Cyanide Compositions Suitable for Electroplating Baths—A. Chester and J. Irwin, assignors to Poor and Company, Chicago, Ill.

Coke oven gases are absorbed in an aqueous alkaline solution which is oxidized with peroxide hypochlorite or permanganate then filtered through activated carbon. To the purified solution is added a metal platable from an alkaline cyanide bath and then plated.

See also No. 2,771,412 which mentions lead, copper, cadmium, bismuth in six claims.

9 claims.

No. 2,771,413, November 20, 1956—Electrodeposition of Chromium—R. Dean, Washington, D. C., and H. Dunn, Crafton, Pa.

A method for producing an electrolyte for chromium plating from chromate ores consists of smelting with carbon to form an iron-chromium alloy, dissolving thin slabs of the alloy anodically in sulfuric acid, removing the iron, and recovering ammonium chromic sulfate.

See also No. 2,771,414 describing making electrolytic chromium (5 claims).

3 claims, figure.

No. 2,771,985, November 27, 1956—Corrosion Resistant Structure—R. Seymour, assignor to The Atlas Mineral Products Co., Mertztown, Pa.

A container for corrosive fluids consists of an inner synthetic resin 5 to 100 mils thick, an outer resin of about the same thickness, spaced ⅛ inch to 2.5 inches apart with sulfur between the two walls.

4 claims, figure.

No. 2,772,227, November 27, 1956—Protecting Molybdenum and Tungsten at High Temperature—M. Quaely and W. Lilliendahl, assignors to Westinghouse Electric Corp., Pittsburgh, Pa.

Molybdenum, tungsten and certain alloy are protected at high temperatures by plating with a chromium-vanadium complex in a bath of 150–350 g/l of CrO_3 and 2–10 g/l of a vanadium salt, also containing acetic acid. The Cr-Va complex is fired in several hours in hydrogen to diffuse the coatings into the article.

5 claims, figure.

No. 2,772,228, November 27, 1956—Preparation of Metal Fluoborates—A. McElroy and R. Hunt, assignors to Callery Chemical Co., Pittsburgh, Pa.

Electrolyze with the desired metal as an anode in an non-aqueous solvent containing an ionic metal fluoborate. The metal fluoborate being substantially insoluble is precipitated and recovered at the anode.

11 claims.

No. 2,772,230, November 27, 1956—Preparation of Zinc Electrolytes—M. Hollander and Y. Lebedeff, assignors to American Smelting and Refining Co., New York, N. Y.

A zinc electrowinning method consists of electrolyzing a zinc

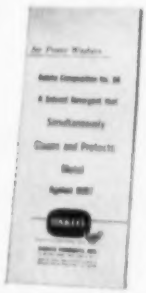
These Oakite shortcuts speed your metal cleaning

1 **Cleaning and rustproofing**—*in one washing operation*

Oakite Composition No. 98 (used cold or hot in one-stage or two-stage washing machines) removes cutting oils and chips—while it leaves a thin film that protects steel against rusting between operations or during temporary storage.

Excellent for cleaning before inspection: the metal is cool for immediate handling and the film (too thin to affect measurements) prevents finger prints from corroding highly finished surfaces.

One auto manufacturer uses No. 98 in seven plants for cleaning and rustproofing brake cylinders, camshafts, connecting rods, crankshafts, cylinder heads, flywheels, push rods, tappets, wrist pins, etc.



2 **Stripping pigmented paints**—*with no need for pickling before repainting*

Oakite Rustripper saves money in paint shops by doing a complete stripping job in one operation. It eliminates extra pickling and neutralizing to remove the metallic pigments, phosphate coatings and rust that prevent successful repainting.

A television manufacturer says "We formerly took 25 minutes to strip rejected cabinets, then had to pickle to remove tarnished phosphate coatings. Today 10 minutes in Rustripper strips the same cabinet so bright and clean you can't tell it from new. Eliminates pickle, neutralize and rinses."

An auto parts maker uses Rustripper for continuous conveyor line stripping. "Cycle of 1 minute and 50 seconds works like a charm stripping paint and incidental rust from rejects and hooks."

3 **Cleaning, derusting and descaling**—*in one alkaline tank*

Oakite Rustripper saves money in plating shops by removing rust or heat scale at the same time it removes oil and other soils. Alkaline pickling with Rustripper avoids hydrogen embrittlement, etching of machined surfaces and other disadvantages of acid pickling. Rustripper is also used for precleaning or electrocleaning in plating lines.

An aircraft manufacturer who formerly sand blasted to remove heat scale says "Now the scale is removed in 30 minutes in a boiling soak in Rustripper."

A job plater who adds Rustripper to his reverse-current cleaner in an automatic plating machine, says "We used to clean 45 seconds. Now 20 seconds cleans sparkling bright . . . saves precious time . . ."

FREE Write for booklets

OAKITE PRODUCTS, INC., 40 Rector St., New York 6, N. Y.

Send me the FREE booklets indicated below:

1 "For Power Washers—Oakite Composition No. 98"
2 "Here's the best shortcut in the field of organic finishing"
3 "Here's the best shortcut in the field of electroplating"

NAME_____

COMPANY_____

ADDRESS_____

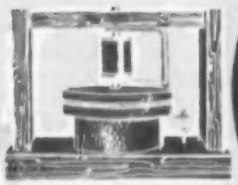
Technical Service Representatives in Principal Cities of U. S. and Canada

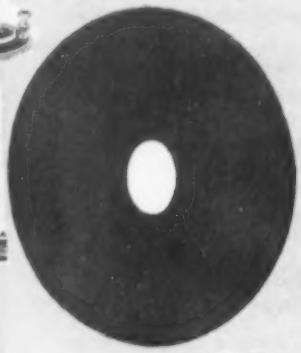
Export Division
Cable Address: Oakite

OAKITE

Famous FIRSTS

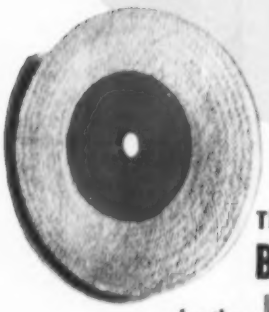
The FIRST ELECTRIC LIGHT BULB by Thomas Edison





The FIRST TELEPHONE by Alexander Graham Bell

The FIRST AIRPLANE by the Wright Brothers



The FIRST BIAS SISAL BUFF by the JOE-D BUFF CO.

Holders of the *Original* Bias Sisal Buff Patent No. 2642706

Specialized know-how and the demands of modern industry . . . these bring progress. The vision of a cool-running, fast-operating buff adaptable to various requirements led to the first Sisal Buff by the JOE-D Buff Co. The amazing efficiency and economy of JOE-D "Fray-Proof" Bias Sisal Buffs marks them as *leaders* in the industry. Specify JOE-D—the *Original* Bias Sisal Buff—for every requirement.

ATTENTION JOBBERS:
Some Choice Territories still available.
Write Today!

the JOE-D BUFF COMPANY
Sandwich, Illinois • Telephone 2171

sulfate electrolyte with an insoluble electrode, cyclically refortifying the spent electrolyte and removing dissolved iron, etc.

3 claims.

No. 2,763,058, September 18, 1956—Process for Producing Steel-Aluminum Bi-Metal Strip—W. McCullough and W. Wyatt, assignors to Bohn Aluminum & Brass Corp., Detroit, Mich.

One side of a steel strip is plated with nickel (0.003–0.00005 in) and brought into contact with a clean strip of aluminum of particular composition. The two strips are heated and run between pressure rolls to bond. An earlier method employed copper as the plated intermediate layer.

3 claims.

No. 2,763,971, September 25, 1956—Apparatus for Applying Abrasive to Buffing Wheels—N. Anderson, assignor to Schlage Lock Co., Calif.

Abrasive is applied to a buffing wheel by bringing a generally cylindrical body of abrasive into contact with the buff. A detailed method of feed is described.

8 claims, 8 figures.

No. 2,764,538, September 25, 1956—Method of Plating Chromium over Antimony—C. Smart, assignor to General Motors Corp., Detroit, Mich.

Bright chromium can be plated over articles of antimony or antimony-base alloys if the articles are immersed in the chromium plating bath at 110–160 F for not more than a minute prior to turning on the current.

5 claims.

No. 2,764,540, September 25, 1956—Electropolishing Inner Surfaces—G. Nelson, and P. Duddy, Warren, Pa., and Wm. Farin, Milwaukee, Wisc.

This method for electropolishing elongated hollow objects depends upon forming an annular electrolytic chamber occupying an elongated limited section of the hollow object. The apparatus is discussed in detail by means of discussion and reference to 10 figures.

11 claims.

No. 2,764,542, September 25, 1956—Apparatus for Continuous Electrolytic Treatment of Articles—A. Pullen, assignor to British Aluminum Co., Ltd., London, England.

A method for electrolytic treatment of wire or strip, particularly anodizing zipper elements, whereby the wire of interconnected elements is drawn through an anodizing bath in which are located insulating boxes carrying insoluble electrodes on either side of the wire, but not touching. The electrodes of box 1 are connected to those in box 2 through an ac or a dc source of current, ac being preferred. Thus, current is not gotten into the wire by contact rolls.

5 claims, 4 figures.

No. 2,765,223, October 2, 1956—Buffing Composition—E. Candee and S. Doughty, Assignors to Lea Mfg. Co., Waterbury, Conn.

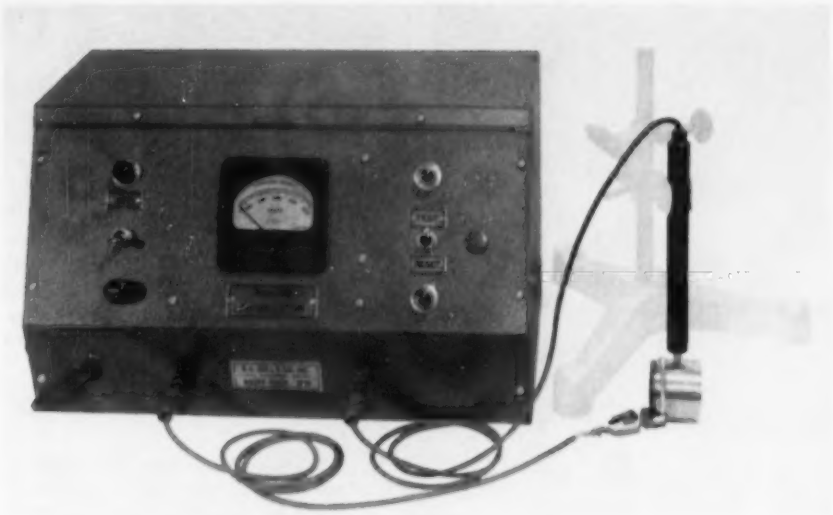
A liquid buffing composition is described as 2½ to 10 per cent of a non-gelling liquid glue, 5 to 10 per cent of diethylene glycol, 2 to 10 per cent of a grease such as higher fatty acids, their glycerides, their ester waxes and petroleum waxes, ½ to 3 per cent of a non-gelling non-ionic surfactant, 45 to 60 per cent of abrasive and 15 to 40 per cent of water.

6 claims.

No. 2,765,269, October 2, 1956—Bath for Plating Bright Gold—B. Ostrow, Belmore, and Fred Nobel, Valley Stream, N. Y.

Bright gold deposits can be obtained by adding to a cyanide gold bath (1) condensation product of a fatty acid with an amino acid of the following formula:

Another EXCLUSIVE ROHCO® Development . . .



THE NEW ROHCO ANODICATOR

automatically checks thickness of Anodic Coatings on Aluminum

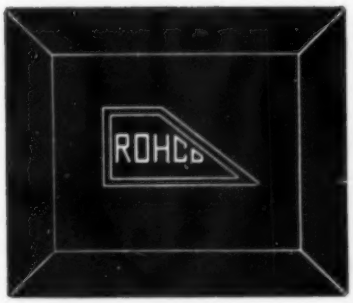
The dielectric test is a simple and reproducible spotcheck on production to obtain anodic coatings conforming to customer specifications.

Completely automatic, the new, approved ROHCO ANODICATOR provides a reliable method of testing anodized aluminum and its alloys as specified in ASTM B110-45. Essential for every anodizing plant. It incorporates two important factors in the measurement of dielectric strength (1) a uniform, slow rate of voltage increase and (2) uniform pressure of the probe on the anodic surface. Features a motor driven voltage elevator; automatically indicates the minimum voltage upon break-through when a light appears; automatically resets to zero voltage.

The ANODICATOR quickly pays for itself by speeding output, eliminating subsequent manufacturing costs of off-standard anodized materials and parts, and reducing rejects.

Find out how the ROHCO ANODICATOR can be an important contribution to your cost-cutting program. SEND FOR FREE INFORMATION, TODAY!

R. O. HULL & COMPANY, INC., 1301 Parsons Ct., Rock River 16, Ohio



JUST PIN THIS COUPON TO YOUR LETTERHEAD

R. O. HULL & COMPANY, INC.
1301 Parsons Court
Rocky River 16, Ohio

Please send descriptive data and price on ROHCO ANODICATOR!

Name..... Title.....

Company.....

Street Address.....

City..... Zone..... State.....

Cuts Evaporation Loss ... Speeds Production

AGILE MINI-VAPS*

Expanded Polyethylene Floats Saved $3,000...Paid For Themselves in 70 Days

■ Money can evaporate! Annually, American industry is robbed of millions of dollars which chemically inert, non-contaminating MINI-VAPS can save as an evaporation and heat barrier. Puncture-proof, non-breakable MINI-VAPS cut process tank evaporation by as much as 75% while they rapidly pay for themselves.

- Designed specifically for vapor retardation.
- Cannot escape through filters or drains or hang up on equipment.
- Light weight and buoyant because of thousands of air cells.
- Engineered surface contours provide extensive interlocking and clustering.
- Prevent spray losses as well as evaporation loss.
- Outstanding chemical and solvent resistance.

As evidence of the amazingly short pay-off time for Mini-Vaps", consider this typical example:

Tank semi-opened, 100 sq. feet surface area, with 1½" layer of Mini-Vaps —

Conditions: Ambient, shop (70° — 85° F.)

Solvent: Dioxane

Evaporation savings per year using Mini-Vaps — $3,400.

Cost of Mini-Vaps*-$652.50

Pay-off time for Mini-Vap installation — 70 days

Write today for detailed literature and prices.

* Trade Mark

AGILENE AGILIDE

AMERICAN AGILE CORPORATION

5461 Dunham Rd., Maple Heights, Ohio

where M = H or alkali metal
R = alkyl radical of 7–17 carbons
R′ = lower fatty acid, alkylmonoalcohol, ester or ether thereof
R″ = methylene, ethylene, propylene radicals

and (2) water soluble salts of nickel or tin. Limits of organic material are 1-100 g/l Ni, 0.1–50 g/l and Sn, 0.01–20 g/l. One condensation product is N-methyl glycine with mixed coconut fatty acids.

7 claims.

No. 2,765,271, October 2, 1956—Electrolytic Cleaning Method—J. Kreml, assignor to Armco Steel Corp., Ohio.

Weld discolored stainless steel is cleaned by moving an electrode over the discolored area, having interposed a 70–85 per cent phosphoric acid solution, with a voltage of 4–24 volts passed between piece and electrode.

1 claim, drawing.

No. 2,765,520, October 9, 1956—Bearing and Method of Making—C. Donley, assignor to General Motors Corp., Detroit, Mich.

A flash of nickel or copper (0.000005–0.00001 in) is plated on a ferrous supporting metal, followed by 0.005–0.1 in of silver and 0.0005–0.0003 in of indium on the silver. The indium and silver are diffused at 300 to 800 F for about 30 minutes.

7 claims, figure.

No. 2,765,590, October 9, 1956—Automatic Buffing Machine—S. Belejack and N. Feingold, assignors to National Silver Co., N. Y.

A machine for polishing flatware is described wherein the pieces are moved down by and up over two juxtaposed buffing wheels.

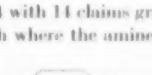
7 claims, figure.

No. 2,766,153, October 9, 1956—Method of Coating Metals with Amine Phosphate Coatings—W. Russell, assignor to Parker Rust Proof Co., Detroit, Mich.

For coating steel, zinc and aluminum the bath consists essentially of phosphoric acid, water and a substituted heterocyclic amine phosphate of the structure

where R is H or hydrocarbon radical with less than 7 carbons. The pH of the solution is 3–6 and 0.017 of phosphate ion must be present.

See also No. 2,766,154 with 14 claims granted to same inventor describing a similar bath where the amine is



11 claims.

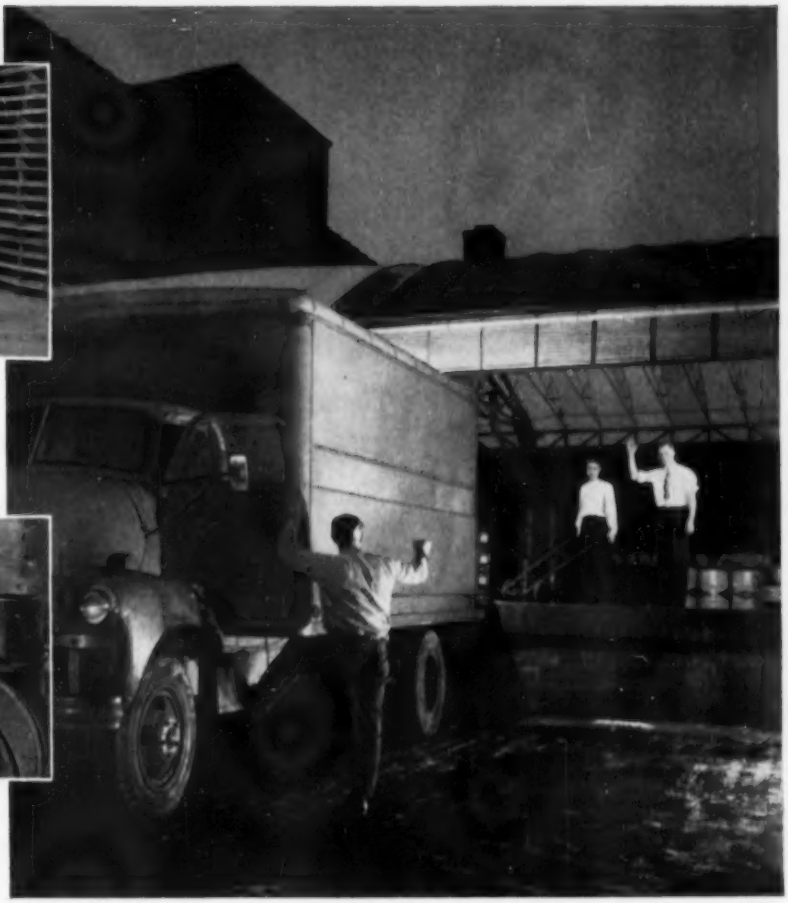
No. 2,766,195, October 9, 1956—Plated Aluminum Bearings—E. Combs, C. Faust and G. Schaer, assignors to American Brake Shoe Co., N. Y.

Clean the bearing shell, dip in a weak sulfuric-oxalic acid solution (10 per cent and ½–10 oz/gal) to remove aluminum oxide after which the shell is plated with tin.

6 claims, figure.

INVENTORY ERROR threatens to halt production at the plant of a large manufacturer in Wisconsin. Unless supplies of two critically needed chemicals are delivered by early evening the second shift will have to be sent home. A long distance call is put through to Merchants' Milwaukee office.

MERCHANTS' WAREHOUSE has been closed for half an hour when the call comes in, but two of the Merchants sales staff volunteer to stay late to help meet the emergency. They load sixty bags and two drums of chemicals onto trucks and flats, ready for pick-up.



AT 8:00 P.M. MANUFACTURER'S TRUCK ARRIVES, is loaded quickly, takes off for a fast return trip. Dinner was late that night for the two Merchants men, but they had been able to help a customer out of a tight spot. That kind of customer service is a tradition at Merchants Chemical.

THEY WERE READY TO SEND THE SECOND SHIFT HOME, UNTIL...

Merchants' Service solved critical supply problem

A distributor, chemical or otherwise, sells service. At Merchants Chemical, service may take the form of emergency accommodation, as in the example cited above; or it may mean experienced technical advice, or special repackaging to help meet a particular production problem. Whatever your need, you'll find that each Merchants office is ready to give your order the special attention it deserves. Merchants serves you from sales offices and stock points across the country. Products offered include acids, alkalis, fungicides, surfactants, chlorinated solvents, emulsifiers, laundry compounds, soaps, dry ice and chemical specialties.

MERCHANTS CHEMICAL COMPANY, INC.

60 East 42nd Street, New York 17, N. Y.

SALES OFFICES AND WAREHOUSES: Chicago • Cincinnati • Columbus • Denver • Louisville • Milwaukee • Minneapolis • New York • Omaha

STOCK POINTS: Albuquerque, N. M. • Erwin, Tenn. • S. Norwalk, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 435.

CONVENTION CHAIRMEN

Mrs. G. R. Davidson
Ladies

P. M. Coady
Educational

G. R. Davidson
General Chairman

C. M. Douglas
Transportation and Outing

J. T. Reisenburg Sr.
Publicity

Tentative Schedule of Events
44TH ANNUAL CONVENTION
Sheraton-Mount Royal Hotel, Montreal, Canada

S. A. Frost
Hotel

J. G. Carrique
Entertainment

B. T. Kelly
Banquet

M. Cohen
Plant Visitation

W. Feeley
Registration

B. Mendels
Finance

J. T. Reisenburg Jr.
Printing

W. Glover
Program

JUNE 16—SUNDAY

9:30 A.M.—National Association of Metal Finishers (NAMF) Annual Meeting	SALONS C-D-E
10:00 A.M.—American Electroplaters' Society (AES) Executive Board Meeting	SALON I
1:00 P.M.—Registration AES (to 9:00 P.M.)	
2:00 P.M.—National Association of Metal Finishers (NAMF) Board Meeting	SALONS C-D-E
8:30 P.M.—AES Get-Together Party	CHAMPLAIN ROOM

JUNE 17—MONDAY

8:30 A.M.—Registration AES (to 9:00 P.M.)	
10:00 A.M.—Opening Session & Business Meeting, Supreme Society, AES	CHAMPLAIN ROOM
12:00 Noon—MFSA Luncheon & Annual Business Meeting	NORMANDIE ROOM
12:00 Noon—Branch Secretaries' Luncheon	SALON B
12:30 P.M.—Speakers' Luncheon	SALON A
2:00 P.M.—National Association Metal Finishers—Seminar	SHERATON HALL
2:30 P.M.—Editorial Board Meeting	SALON F
2:30 P.M.—First Educational Session	CHAMPLAIN ROOM
6:00 P.M.—National Association Metal Finishers—Cocktail Party & Dinner	SHERATON HALL
6:00 P.M.—Chandeysson Electric Company—Cocktail Hour	SALON F
6:30 P.M.—Past Presidents' Dinner	SALON B
8:30 P.M.—Open House MFSA Hosts—*Dancing & Buffet*	CHAMPLAIN & BALLROOM

JUNE 18—TUESDAY

8:00 A.M.—Speakers' Breakfast	SALON A
8:00 A.M.—Research Committee Breakfast	SALON D
9:00 A.M.—Registration AES (to 9:00 P.M.)	
9:00 A.M.—Public Relations Committee Meeting	SALON C
9:30 A.M.—Second Educational Session	BALLROOM
9:30 A.M.—Third Educational Session	CHAMPLAIN ROOM
12:00 Noon—Branch Librarians' Luncheon	SALON L
12:30 P.M.—Speakers' Luncheon	SALON A
2:00 P.M.—Fourth Educational Session	CHAMPLAIN ROOM
2:00 P.M.—Research Committee Meeting	SALON J
4:00-8:00 P.M.—Cocktail Party—International Nickel Company	SALON L
5:30-9:00 P.M.—Association of Federated Metals—Reception	BALLROOM
6:00-7:30 P.M.—Canadian Hanson & Van Winkle Company—Cocktail Party	CHAMPLAIN ROOM
7:30-9:00 P.M.—Ladies' Plato Party	SHERATON HALL
7:30-9:00 P.M.—Technical Motion Picture	CARTIER ROOM

JUNE 19—WEDNESDAY

8:00 A.M.—Speakers' Breakfast	SALON A
8:00 A.M.—Michigan State Breakfast	SALON B
8:00 A.M.—Fifth Educational Session	CHAMPLAIN ROOM
8:30 A.M.—R. O. Hull Breakfast Meeting	NORMANDIE ROOM
9:00 A.M.—Registration AES (to 9:00 P.M.)	
11:00 A.M.—Laurentian Trip (Outing)	
5:30 P.M.—DuPont Reception	SALON B OR CARTIER TERRACE
8:45 P.M.—Floor Show and Dance	BALLROOM & CHAMPLAIN ROOM

SIGHTSEEING TOURS

Seeing Montreal

Among the historic places of interest in Montreal that conventioneers will want to see are the Chateau de Ramezay, Lookout atop Mount Royal, St. Lawrence Seaway, St. Joseph's Oratory, Christ Church Cathedral, Temple Emmanuel, Notre Dame Church, the Wax Museum, McGill University, University of Montreal, the Botanical and Lafontaine Park.

Tours can easily be arranged. The Night Club Tour consists of a full night of entertainment at the Bellevue Cafe Casino, Montreal's largest night spot. Included are a full course dinner—broiled fillet mignon; fine floor show which features, along with French Canadian talent, imported stars from New York and Paris, plus the famous Bellevue Casino chorus line. Dancing to The Bellevue's famous orchestra. Transportation to and from The Bellevue.

Seaway and Mohawk Indian Tour

History is being made on the continent today by great industrial and engineering achievements. Perhaps the most spectacular engineering feat is the construction of the St. Lawrence Seaway.

Comfortable "Sky View" motor coaches give the one chance in a lifetime to see this major construction project on afternoon lectured sight seeing tour. From the starting point in Montreal you proceed over the St. Lawrence river. During the crossing you will obtain a bird's-eye view of the harbor and an important segment of the seaway project. Following the bridge crossing you will proceed along the south shore where this major seaway development is taking place.

Along with your trip into the future you will take a trip into the rich historical past of Canada, for this tour also includes a visit to Caughnawagn, the first Indian reservation founded. Here the Indians perform a pageant with all the braves attired in native dress.

The lecturer will point out the Old French Church where services are still conducted in the language of the Iroquois.

City Tour

This sightseeing tour of greater Montreal gives the visitor a comprehensive tour of the city and its environs. The tour covers a distance of approximately 18 miles, and over 200 points of scenic and historic interest.

Visit the Lookout on top of Mount Royal mountain.

Trip in a horse-drawn carriage in Mount Royal Park.

Stop at Notre-Dame Church which can accommodate 10,000 persons.

McGill and Montreal Universities—New General Hospital—St. Joseph's Oratory.

Residential sections of Westmount, Outremont, the Old French District of the city and the Montreal Harbor.

Spacious lobby of the Sheraton-Mount Royal, Montreal Headquarters Hotel for the AES 44th Annual Convention, June 16-20.

TENTATIVE MONTREAL CONVENTION PAPERS

From among these 27 papers, 23 are to be selected for delivery:

1. **Levelling in Cyanide Copper Baths—A Further Study**
2. **Brite and Semi-Brite Crack-Free Chromium**
3. **Effects of Plating on High Tensile Strength Steels**
4. **Corrosion Resistance of Tin and Tin Alloy Electro Deposits**
5. **New Look in Plating Room Power**
6. **Future of Plastics in Electroplating Plant**
7. **Sealing of Anodic Aluminum Oxide Films**
8. **Plating of High Density Tungsten-Base, Powdered Metal Alloys**
9. **Nickel Plating on Nickel and Nickel Alloys**
10. **The Influence of the Basis Metal on the Durability of Watts Nickel Deposit**
11. **Iridium Plating and Its High Temperature Oxidation Resistance**
12. **Ultrasonics**
13. **Surface Catalyzed Reduction of Copper**
14. **Impurities in Chemical Bright Dip Solutions for Aluminum—Their Effect and Removal**
15. **Barrel Plating**
16. **A Study of Application Technique in the Use of Liquid Buffing Compound**
17. **Corrosion and Materials of Construction in the Plating Room**
18. **Further Studies in Nickel Iron Alloy Electrodeposits**
19. **Electrodeposits as Resists in Selective Heat Treating**
20. **A Study of the Effects of Various Forming Electrolytes on the Anodic Film**
21. **The Effect of Steel-Making Processes on the Properties of the Surface of Steel Plate**
22. **Electroplating Chromium on Titanium**
23. **Factors Governing Buff Wear**
24. **Analytical Methods for the Tracing of Quantities of Cyanide Compounds in the Plating Room Effluent**
25. **The Role of Chromate Treatments in the Finishing of Aluminum**
26. **Scisal Buffing**
27. **Industrial Chromium Plating—a film**

SCHEDULE OF EVENTS—Continued

JUNE 20—THURSDAY

8:00 A.M.—Speakers' Breakfast	SALON A
9:00 A.M.—Registration AES (to 6:00 P.M.)	
9:30 A.M.—Sixth Educational Session	CHAMPLAIN ROOM
9:30 A.M.—AES Business Meeting, Supreme Society (all day)	SHERATON HALL
5:00 P.M.—Hanson-Van Winkle-Munning Company—Cocktail Party	SHERATON HALL
7:00 P.M.—Banquet and Dance	BALLROOM & CHAMPLAIN ROOM
11:00 P.M.—Udylite Company Closing Party	SHERATON HALL
11:00 P.M.—Reception	SALONS C-D-E

JUNE 21—FRIDAY

10:00 A.M.—Executive Committee Meeting AES (throughout the day)	SALON I

This is a tentative list. Additional ladies events, golf tournaments and other convention features still to be announced.

HOTEL RESERVATION FORM

44th Annual Convention, American Electroplaters' Society
Montreal, Que., Canada — June 16-20, 1957.

MONTREAL TOURIST &
CONVENTION BUREAU INC.,
Suite M 30,
Sheraton Mt. Royal Hotel,
1455 Peel Street,
Montreal, Canada.

To assure satisfactory accommodations return this reservation form NOT LATER THAN JUNE 1. No reservations will be accepted by the Bureau after that date.

You will receive confirmation directly from your hotel, and from the Housing Registrar.

Hotel	*Single Bed Room*	*Double Bed Room*	*Twin Bed Room*	*Suite*
*SHERATON MT. ROYAL ..... Peel Street.	$8.85	$10.35 to $12.35	$11.85 to $15.50	$22.00 up-S 24.00 up-D
WINDSOR HOTEL ..... Windsor Street.	9.00	9.00 to 11.00	9.00 to 12.00	17.00 up-S 21.00 up-D
*LAURENTIEN HOTEL ..... Windsor Street.	$9.85	9.85 to 11.85	10.85 to 12.85	

*These Hotels have a Family Plan. No charge for children under 14 years, when accommodated in parents' room.

INDICATE YOUR CHOICE OF ACCOMMODATION

Number of		*Name of Hotel*		CHECK HOTEL
Single Bed Rooms	☐	SHERATON MT. ROYAL HOTEL	☐	First, Second and Third Choice — 1, 2, 3.
Double Bed Rooms	☐	WINDSOR HOTEL	☐	
Twin-Bed Rooms	☐	LAURENTIEN HOTEL	☐	
Suites	☐			

Single rooms are in short supply. When the supply of Single Rooms allotted for this Convention is exhausted, persons requesting Single Rooms will be assigned to a Twin Bed Room to be shared with another person.

If you are willing to share a Twin Bedroom in the first instance, please indicate. ☐

Rooms indicated above will be occupied by: (Designate those who will share same room)

NAME | STREET ADDRESS | CITY & STATE OR PROVINCE

.....

.....

.....

ARRIVAL DATE ..... HOUR ..... A.M. P.M. ..... DEPARTURE DATE .....

PLEASE PRINT Date of this Application 1957

Applicant ..... Company .....

Street Address ..... City ..... Zone ..... State or Province .....

NO.:

410 PLATING

IF YOU HAVE NOT ALREADY MADE YOUR HOTEL RESERVATION, FILL OUT THIS FORM AND MAIL PROMPTLY

TEAR OUT

INDICA
B 404.

LEA SATIN FINISH

...in modern lamp fashions by LIGHTOLIER

it's a finish that's

functional, fashionable, economical

As modern as tomorrow . . . this lamp from Lightolier's Fleetwood Collection created by Gerald Thurston, engineered by Lightolier, and the trim satin finished with Lea Compound. Lightolier says this LEA Satin Chrome Finish was chosen because it's modern, it harmonizes with other finishes and it's extremely durable. And we might add that it's a finish that's economical to produce.

Why not go modern on your finishing line? Why not try a Lea Satin Finish on your product? It will look terrific, it will have real consumer appeal and it will reduce your finishing costs.

Write or call us for an answer to your finishing questions.

Buffing, Blending, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions. Manufacturers of Lea Compound and Loarsk . . . Industry's quality buffing and polishing compounds for over 30 years.

The Hallmark of Quality Products

THE LEA MANUFACTURING CO.

16 CHERRY AVE., WATERBURY 20, CONN.

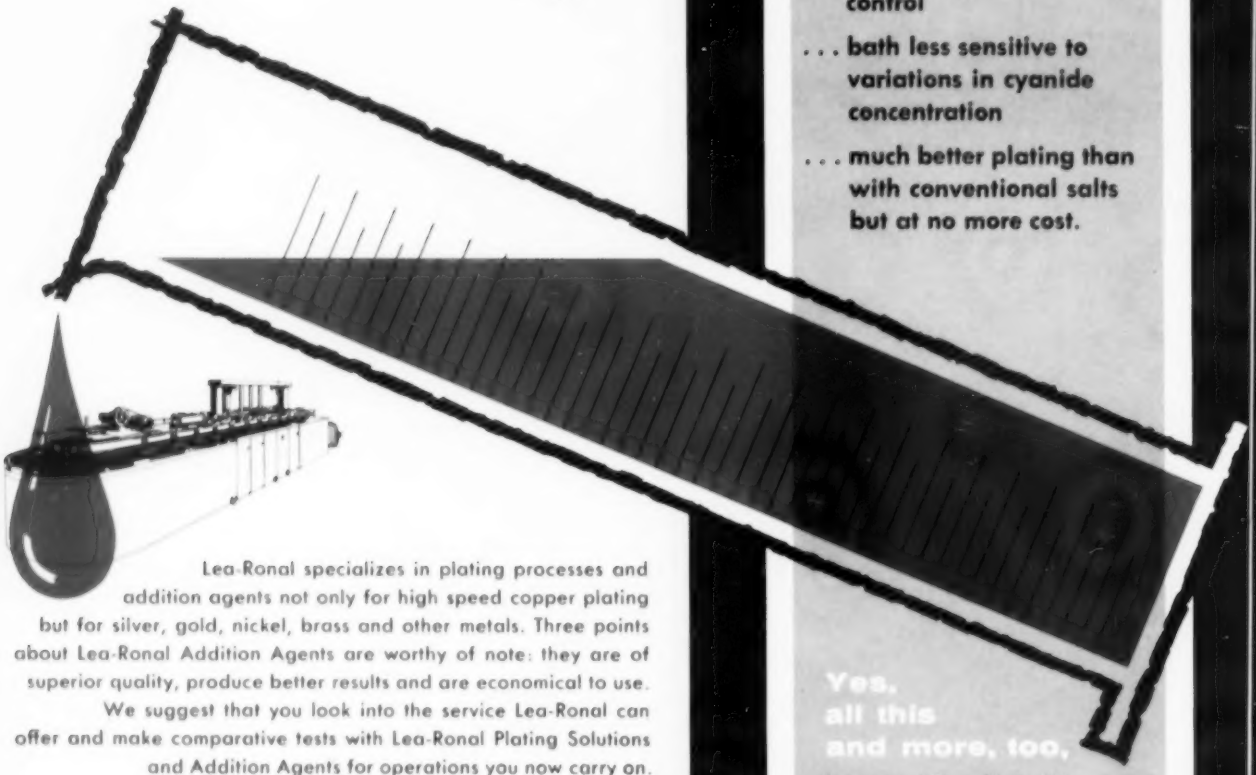
Lea-Michigan, Inc., 14066 Stansbury Ave., Detroit 27, Mich.
Lea Mfg. Company of Canada, Ltd., 1226 Birchmount Road Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, England
Lea-Ronal, Inc., Main Office and Laboratory: 139-20 109th Ave., Jamaica 35, N. Y.
Manufacturing Plant: 232 East Ayrault St., Phoenix 2, Ariz.

Are you interested in Plating Specialties? **SEE THE OTHER SIDE OF THIS INSERT.**

ultra-tartral

ALL THIS....

- **. . . increase in allowable current density**
- **. . . elimination of burning**
- **. . . elimination of carbonate control**
- **. . . bath less sensitive to variations in cyanide concentration**
- **. . . much better plating than with conventional salts but at no more cost.**



Lea-Ronal specializes in plating processes and addition agents not only for high speed copper plating but for silver, gold, nickel, brass and other metals. Three points about Lea-Ronal Addition Agents are worthy of note: they are of superior quality, produce better results and are economical to use. We suggest that you look into the service Lea-Ronal can offer and make comparative tests with Lea-Ronal Plating Solutions and Addition Agents for operations you now carry on. Write us in detail and we'll be glad to recommend the proper Lea-Ronal product for your needs.

Yes, all this and more, too,

because Ultra-Tartral is one of the most carefully formulated and one of the most versatile addition agents for cyanide copper plating* to come on the market.

*Especially adapted to the Lea-Ronal Bright Copper Process

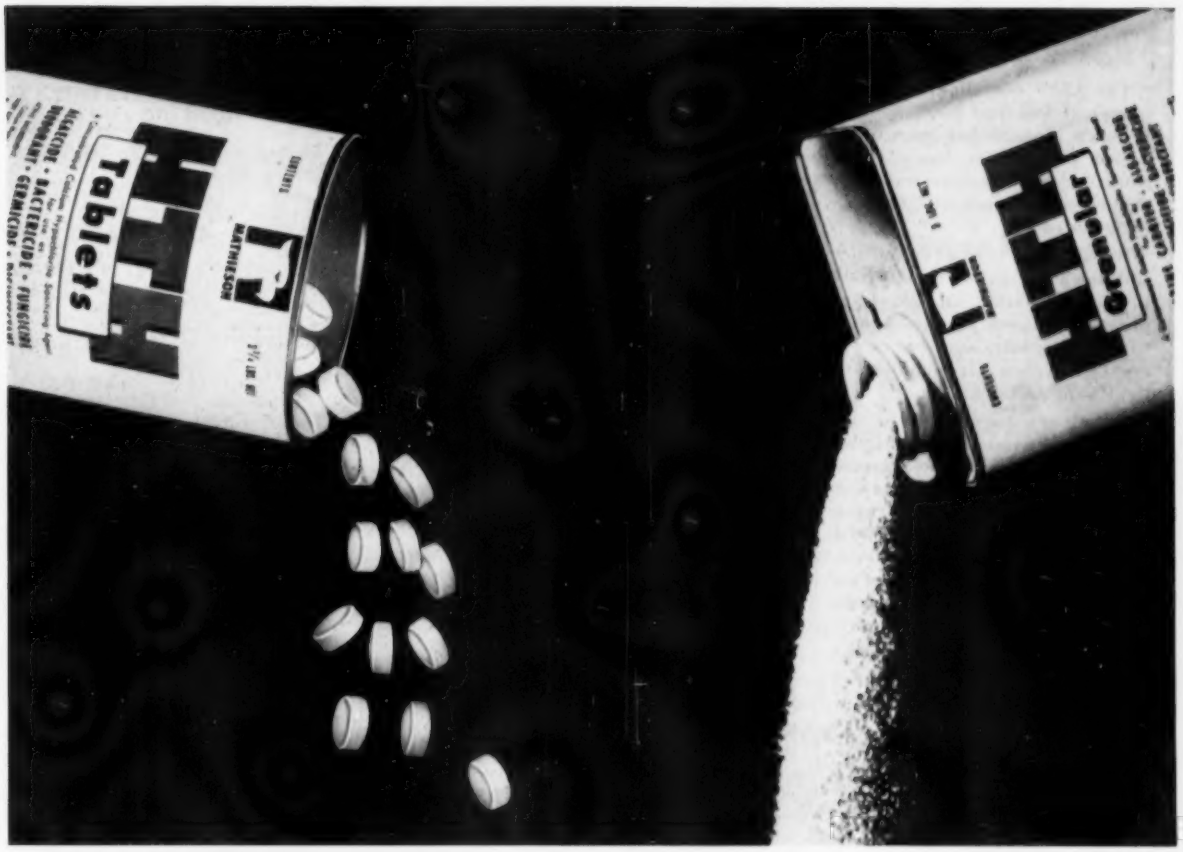
The LEA GROUP
serving the Finishing Field
Lea-Ronal, Inc., Jamaica, N. Y.
Lea-Michigan, Inc., Detroit
The Lea Mfg. Co., Waterbury, Conn.
Lea Mfg. Co., of Canada, Ltd.
Lea Mfg. Co., of England, Ltd.
Plating, Polishing, Buffing, Burring

Lea-Ronal Inc.

Sales and Manufacturing Plant:
237 East Aurora Street, Waterbury 20, Conn.

Main office and Laboratory:
139-20 109th Avenue, Jamaica 35, N. Y.

Are you interested in Buffing, Polishing and Burring Specialties? SEE OTHER SIDE OF THIS INSERT



Neutralize dangerous cyanide waste with "dry" chlorine . . . **HTH**

Chlorine products are winning wide acceptance in the treatment of cyanide waste. And of all chlorine products, none is more effective, convenient, and economical than HTH.

EFFECTIVE . . . because HTH goes to work immediately, releasing the hypochlorite solution that quickly converts cyanide to relatively harmless cyanate.

CONVENIENT . . . because HTH is chlorine in *dry* form, it can be added directly to waste solutions. It's perfectly safe and simple to store, use and handle at all times.

ECONOMICAL . . . because with HTH you need no costly equipment, no technically trained personnel. You eliminate the use of carboys and the breakage, spilling and waste that frequently occur.

HTH comes in two forms. **HTH Granular**—***non-dusty, free-flowing and fast-dissolving—is packed in 100-lb. drums and in cases of nine 5-lb. cans.*** **HTH Tablets**—***a slow, steady source of chlorine over longer periods—are packed in 100-lb. drums and in cases of twelve 3¾-lb. cans.***

Check your supply house on the use of HTH in treating cyanide waste. Or you can obtain further information by simply writing.

HTH® is a trademark

HTH OLIN MATHIESON CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION · BALTIMORE 3, MD.

4950

Manual Available to Branches

The AES's consolidated mimeographed looseleaf book Branch Officer's Manual has been completed and copies have issued from National Headquarters to all Branches that ordered them at $5.50 per copy.

Within red covers bound by Chicago screws, the Manual contains information on respective phases of Branch operation vital to the successful workings of every AES Branch. It includes five final supplements.

A limited extra quantity of the book is still available at National Headquarters for the accommodation of Branches that have not previously ordered copies. These will be sold to Branches (only), on a first-come, first-served basis so long as that supply lasts, at $5.50 per copy, including postage to one destination.

Write American Electroplaters' Society, Inc., American Building, 445 Broad Street, Newark 2, N. J. Payment should accompany order to obviate unnecessary bookkeeping expense.

Opportunity to Authors

Authors of technical and scientific papers on electroplating, metal finishing and related arts are cordially invited to submit manuscripts of original, unpublished papers to the Editor of PLATING for review and publishing consideration.

Any such paper accepted and published in PLATING will also become eligible, of course, for selection by the Society's PAPER AWARDS COMMITTEE for the Carl E. Heussner Award, George B. Hogaboom Award, AES Bronze Medal Award, Robert S. Leather Award, Chromium Plating Award or the Precious Metal Plating Award.

Though the submission of any such papers by AES members or non-members will be welcomed by PLATING any time during the year, this current period is particularly recommended. So as to expedite review and other processing, please write the Editor, PLATING, 445 Broad Street, Newark 2, New Jersey, for full particulars before submitting your manuscript.

ARTICLE REFERENCES

By
WILLIAM TUCKER
Eastman Kodak
Rochester, N.Y.

Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

240. ANALYSIS

a. *DETERMINING IRON IN CHROMIUM PLATING SOLUTIONS.*
Dr. Heinz W. Dettner, Bielefeld, Germany.
Metal Finishing, *55*, No. 2, February 1957, p. 67.

b. *A NEW METHOD FOR THE DETERMINATION OF SULPHATE IN CHROMIUM PLATING SOLUTIONS.*
C. J. Keattch.
Electroplating and Metal Finishing, *10*, No. 1, January 1957, p. 2–6.

241. CLEANING

a. *CHELATING AGENTS IN METAL CLEANING AND DERUSTING.*
J. K. Aiken.
Electroplating and Metal Finishing, *10*, No. 2, February 1957, p. 31–35.

b. *CLEANING BY ULTRASONICS.*
J. Lomas.
Machinery Lloyd (Overseas Edition), *28*, December 8, 1956, p. 94–96.

242. CORROSION

a. *STUDY OF A SIZE EFFECT IN GALVANIC CORROSION.*
James T. Waber.
Corrosion, *13*, No. 2, February 1957, p. 25–32.

b. *USE OF HIGH SILICON CAST IRON FOR ANODES.*
Corrosion, *13*, No. 2, February 1957, p. 33–37.

c. *THE USE OF GRAPHITE AS DUCT ANODES.*
A. L. Ayres.
Corrosion, *13*, No. 2, February 1957, p. 38–40.

d. *MEASUREMENT OF THE INSTANTANEOUS CORROSION RATE BY MEANS OF POLARIZATION DATA.*
R. V. Skold and T. E. Larson.
Corrosion, *13*, No. 2, February 1957, p. 69–72.

243. DESCALING

a. *DESCALING TITANIUM SHEET.*
W. J. Barth.
Steel, *139*, December 31, 1956, p. 62–63.

244. EDUCATIONAL

a. *SCIENCE FOR ELECTROPLATERS. THROWING POWER.*
L. Serota.
Metal Finishing, *55*, No. 2, February 1957, p. 68–72.

245. ELECTRODEPOSITION

a. *SURFACE TREATMENT AND FINISHING OF LIGHT METALS. PART XII-C. PLATING ON ALUMINUM—ZINC IMMERSION PROCESSES.*
S. Wernick and R. Pinner.
Metal Finishing, *55*, No. 2, February 1957, p. 61–65.

b. *THE MECHANISM OF DEPOSITION OF TITANIUM COATINGS FROM FUSED SALT BATHS.*
M. E. Straumanis, S. T. Shih and A. W. Schlechten.
Journal of the Electrochemical Society, *104*, No. 1, January 1957, p. 17–20.

c. *ELECTRODEPOSITION OF METALS FROM ORGANIC SOLUTIONS. III. PREPARATION AND ELECTROLYSIS OF TITANIUM AND ZIRCONIUM COMPOUNDS IN NONAQUEOUS MEDIA.*
W. E. Reid, Jr., J. M. Bish and Abner Brenner.
Journal of the Electrochemical Society, *104*, No. 1, January 1957, p. 21–29.

d. *ELECTRODEPOSITION OF METALS FROM ORGANIC SOLUTIONS. IV. ELECTRODEPOSITION OF BERYLLIUM AND BERYLLIUM ALLOYS.*
Gwendolyn B. Wood and Abner Brenner.
Journal of the Electrochemical Society, *104*, No. 1, January 1957, p. 29–37.

e. *ELECTRODEPOSITION OF METALS FROM ORGANIC SOLUTIONS. V. ELECTRODEPOSITION OF MAGNESIUM AND MAGNESIUM ALLOYS.*
Jean H. Connor, Walter E. Reid, Jr. and Gwendolyn B. Wood.
The Journal of the Electrochemical Society, *104*, No. 1, January 1957, p. 38–41.

246. INHIBITION

a. *SELECTION OF RUST INHIBITORS TO MEET SERVICE REQUIREMENTS.*
A. J. Freedman, A. Dravnieks, W. B. Hirschmann and R. S. Cheney.
Corrosion, *13*, No. 2, February 1957, p. 19–24.

247. MECHANICAL FINISHING

a. *SHOT BLASTING AND SHOT PEENING OF LIGHT ALLOYS.*
F. Flusin.
Electroplating and Metal Finishing, *10*, No. 1, January 1957, p. 15–18.

b. *FACTS ABOUT VAPOR BLASTING.*
H. F. Patin.
Products Finishing, February 1957, p. 66–76.

c. *WHY CENTERLESS BRUSHING FINISHES FASTER.*
R. C. Sasena.
The Iron Age, *179*, No. 8, Febru-

See what these NEW filters can do!

- **Economical recovery of valuable material.**
- **Simplified disposal of filter cake.**
- **Choice of power openings.**
- **Rapid self-cleaning devices.**
- **Complete automation or push-button control for all filtering and cleaning actions.**

If you think cleaning filters is a messy, costly job . . . take a good look at one of the new Industrial Vertical Filters.

The dirty work of cleaning has been changed to a push button routine with self-cleaning features like air wash, sluicing devices, mechanical shakers and something that has been needed for years . . . *cake discharge outlets where you need them!*

Industrial can help you organize a filtration system that fits your process like a hand in a glove. You can quickly recover or dispose of filter cake in wet, semi-solid or dry form. Filters can be made completely automatic or with any degree of manual control desired. Arranged in pairs or series, they eliminate down time or pressure drop in continuous processing. They are available with corrosion resistant linings or temperature insulation jackets.

Why not look into the advantages of modern filtration for your process? Analyses and recommendations by Industrial cost nothing...but can lead to better product quality and more economical processing. Write or call Industrial to see a qualified representative.

For more details on Industrial Filters, ask for Bulletin 111

Industrial

INDUSTRIAL

FILTER & PUMP MFG. COMPANY

5914 OGDEN AVENUE • CHICAGO 50, ILL.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 438.

ary 21, 1957, p. 91–93.

d. *METAL POLISHING WITH SET-UP WHEELS.*
R. S. Burt.
Metal Finishing, *55*, No. 2, February 1957, p. 52–55.

248. MISCELLANEOUS

a. *STUDY OF THE CATHODIC REDUCTION OF OXIDE FILMS ON IRON. I. REDUCTION OF ALPHA-FE_2O_3 FILMS.*
H. G. Oswin and M. Cohen.
Journal of the Electrochemical Society, *104*, No. 1, January 1957, p. 9–16.

b. *WETTING AGENTS AND BUFFERS IN CLEANING AND ELECTROPLATING.*
Edward Engel.
Products Finishing, February 1957, p. 32–34.

c. *STRESS IN ELECTRODEPOSITS.*
R. Pinner.
Electroplating and Metal Finishing, *10*, No. 1, January 1957, p. 7–11.

d. *CLEANING AND FINISHING FORUM ON TECHNICAL PROGRESS.*
Steel, *140*, January 7, 1957, p. 374–384.

249. NICKEL

a. *THE EFFECT OF CERTAIN CONSTITUENTS OF TANK LININGS ON NICKEL ELECTRODEPOSITS. AN INVESTIGATION COVERING RUBBER AND PLASTIC MATERIALS.*
J. Edwards.
Electroplating and Metal Finishing, *10*, No. 2, February 1957, p. 41–43.

250. ORGAINC FINISHING

a. *WHAT WE EXPECT OF FINISHES FOR THE AUTOMOTIVE INDUSTRY.*
Ralph J. Wirshing.
Products Finishing, February 1957, p. 52–62.

b. *COATINGS FOR USE WITH CATHODIC PROTECTION.*
Organic Finishing, January 1957, p. 15–16.

251. PHOSPHATING

a. *THE EFFECT OF THE CHROMIC ACID RINSE ON PHOSPHATE COATINGS.*
Jodie Doss, W. Dennis McHenry and Stanley L. Eisler.
Organic Finishing, February 1957, p. 4–6.

252. PLANT DESIGN

a. *DESIGN AND CONSTRUCTION OF A NEW PLATING DEPARTMENT.*
R. I. Horrocks.
Metal Finishing, *55*, No. 2, February 1957, p. 56–60.

253. PREPARATION

a. *SURFACE TREATMENT OF TITANIUM.*
H. Richaud.
Metal Industry, *89*, December 14, 1956, p. 496–497.

254. RECTIFICATION

a. *PROTECTION OF GERMANIUM RECTIFIERS FOR ELECTROPLATING.*
Stuart P. Jackson.
Products Finishing, February 1957, p. 36–40.

255. RHODIUM

a. *ELECTRODEPOSITED RHODIUM IN CO-AXIAL RADIO-FREQUENCY CIRCUITS.*
D. O. Walter.
Electroplating and Metal Finishing, *10*, No. 2, February 1957, p. 44–46.

Requests for articles should be made directly to the following addresses of the publications named in the Article References above.

Corrosion
1061 M & M Bldg.
1 Main Street
Houston 2, Texas

Electroplating and Metal Finishing
85 Udney Park Road
Teddington, Middlesex
England

Iron Age
Chilton Co., Inc.
Chestnut and 56th Sts.
Philadelphia 39, Pa.

Journal of the Electrochemical Society
216 West 102nd Street
New York 25, N. Y.

Machinery Lloyd (Overseas Ed.)
6 Cavendish Place
Regent Street
London, W1
England

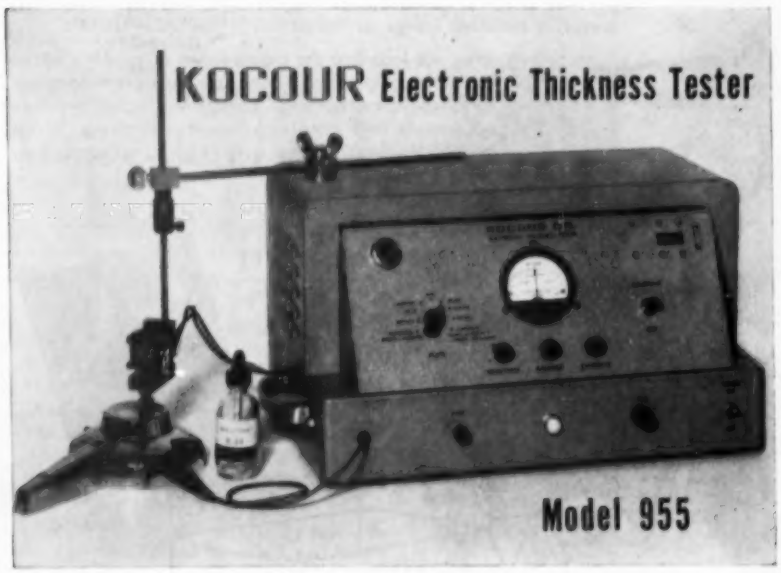
Metal Finishing
Finishing Publications, Inc.
381 Broadway
Westwood, N. J.

Metal Industry
Dorset House
Stamford Street
London, SE 1
England

Organic Finishing
381 Broadway
Westwood, N. J.

Products Finishing
Gardner Publications, Inc.
431 Main Street
Cincinnati, Ohio

Steel
Penton Building
Cleveland 13, Ohio



A NEW MODEL . . .

to solve your plating thickness problems!

Here's the New Model 955 . . . the answer to your plating thickness problems . . . a single instrument with a wider application than most other methods. And in addition, human error is virtually eliminated . . . operation is simple and automatic . . . readings are direct . . . accuracy 90–95% . . . results are reproducible . . . average test requires about one minute.

New Calibration feature ensures "long term" accuracy!

The accuracy of a thickness test can be no better than the accuracy of the method used. The Kocour Electronic Thickness Tester Model 955 gives you direct readings with an accuracy of 90–95%. Furthermore, with the new Calibration feature used in conjunction with Kocour Thickness Standards, you can not only check the accuracy, but calibrate the instrument to automatically correct slightly high or low readings. In addition any malfunctions due to a defective component will be indicated. Don't risk the quality of your product any longer . . . get the deta'ls on the New Model 955 today!

Ask for a demonstration or 15-day Free Trial!

KOCOUR CO.

Pioneers in Control for the Plating Industry

4801 S. St. Louis Avenue, Chicago 32, Illinois

Get the results you want from Wyandotte's Barrel-Finishing Compounds

BURNEK 22—Minimum running time gives exceptionally brilliant luster to brass, copper, nickel, silver and gold. Low cost, uniform results.

ALTREX®—For quick cleaning, cut-down, de-burring of steel, aluminum, brass, die castings. An economical, all-purpose de-burring compound.

BURNEK 452—Nonfoaming, free-rinsing combination cleaner-burnisher for steel, stainless steel; quickly develops high luster.

BURNISHING COMPOUND 321—Non-toxic brightening agent easily removes light tarnish; excellent for zinc, brass, copper, bronze, steel, stainless steel, gold.

A.E.—Powdered acid compound for brightening steel, stainless steel, brass, copper. Removes scale, rust, tarnish, spot-weld marks, flux from brazing operations.

BARREL FINISHING can be an especially economical way of finishing parts when you use one of Wyandotte's barrel-finishing compounds.

You see, Wyandotte produces de-burring and burnishing compounds to cover all phases of your finishing operations. Each of these products has been tested, proven in operation; each will lower your over-all costs through low use-costs.

Whatever your finishing problem—from paper clips to zinc die castings—there's a Wyandotte product to solve it—efficiently, economically. Why not call your Wyandotte representative today.
Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.

Wyandotte CHEMICALS

J. B. FORD DIVISION

The best in chemical products for metal finishing

INTERSOCIETY NEWS

Electrochemical Society To Meet

Six Divisions of The Electrochemical Society, Inc., will hold sessions at its 111th meeting at the Hotel Statler, Washington, D. C., from May 12 to 16, 1957.

The Electric Insulation Division has scheduled symposia on: New Material Developments; Thermal Evaluation and Classification of Materials; Insulation Life; Prefabricated Circuitry; and a panel discussion on High Temperature Capacitors.

The Corrosion Division and Electrothermics and Metallurgy Division have scheduled a joint symposium on the Role of Metal and Oxide Structure in Oxidation and Corrosion.

The Electronics Division has scheduled sessions on Luminescence, Semiconductors, Thermionic Cathodes, Instrumentation, and Screen Applications.

The Electrothermics and Metallurgy Division has scheduled a symposium on Chemical Metallurgy, and another symposium on Columbium (Niobium).

The Industrial Electrolytic Division has scheduled one symposium on Fused Salt Electrolysis, and another on Chlor-Alkali processes.

The Theoretical Electrochemistry Division, ECS, and the National Science Foundation have scheduled a joint symposium of six sessions on the Structure of Electrolytic Solutions (Electrolytes); speakers from all over the world will present papers at this symposium. The Theoretical Electrochemistry Division, ECS, has also scheduled two general sessions.

Vacuum Metalizers Organizing a Society

A committee to investigate the organizing of a society or association for those directly concerned with vacuum metalizing met January 31, 1957 in Cleveland.

It was concluded that because of wide interest in all types of vacuum metalizing such an organization has definite value. The idea of joining as a group with other organizations was explored. Because some metalizers are specializing in the vacuum coating of metal and not plastic, the suggestion of tying in with the Society of Plastic Industries was rejected. Because the Committee on Vacuum Techniques serves only research personnel, it was recommended that liaison only be established with their organization for such purposes as exchanging technical papers, etc.

The name of the organization will not be decided upon until the next meeting. Choice of names include: Vacuum Metalizing Association, Vacuum Plating Association, Vacuum Metalizing Society, Vacuum Plating Society, Vacuum Coating Association, Society of Vacuum Coaters, Society of Vacuum Platers.

At the next meeting, a Committee on Constitution and By-laws will be appointed. This committee will also determine from what type of organizations membership should be derived.

Selection of officers will not take place until several meetings have elapsed. Mr. LaBounty has been elected temporary chairman in the interim.

New Committee Helps Job Platers

Increased business lies ahead in the job plating industry, due to recent action by H. B. McCoy, administrator, Business and Defense Services Administration, according to P. Peter Kovatis, executive secretary, National Association of Metal Finishers.

Information from the U. S. Department of Commerce reveals the establishment of an Electroplating Industry Advisory Committee to "provide the most effective means for permitting the Commerce Department to obtain advice and counsel" on problems of nickel and other metals.

"This action is unprecedented in the annals of the job plating field," said Mr. Kovatis, "for it marks the first time to our recollection that the industry has been asked to take part in top level industry-Government planning. Ostensibly, one of the tasks of the new committee will be to assist in setting up plans and procedures for the equitable distribution and allocation of nickel and other metals."

It is reported that the committee will also assist in curbing gray and black market practices in the plating field. In addition, the committee will strive to obtain a fair selling price for nickel and other metals.

For the past two years, the NAMF has fought to obtain more nickel for job shop platers. Their struggle and plea was carried to Washington where a sympathetic Select Committee on Small Business, under the aegis of Senator John Sparkman (D., Alabama) listened, investigated and took action which culminated in the formation of the committee.

"The expected increase in nickel allocation to platers is certain," points out Mr. Kovatis, "but it will be several months before anything concrete is worked out."

Credit goes to many including John Palik Jr., Cleveland, NAMF president; Mariano Ranno, Brooklyn, NAMF nickel committee chairman; and Silvio C. Taormina, New York, NAMF technical adviser.

Corrosion Research Council Reports on First Project

The first research project of the Corrosion Research Council of the Engineering Foundation, entitled "Fundamental Corrosion Reactions at the Surfaces of Metals in Selected Environments," was begun at the National Bureau of Standards early in January 1956, and in January 1957 a report of the first year's work was made. The first project was under the direct supervision of an advisory committee headed by Dr. A. T. Gwathmey of the University of Virginia and an internationally recognized authority on surface reactions of the environment with high-purity metals.

National Bureau of Standards scientists were chosen to carry out the Council's first project because of obvious advantages. The Bureau is richly endowed with facilities for basic research, both in unusual physical equipment and in trained specialists who can bring the valuable effect of teamwork to bear on a research problem. Also, in view of the Bureau's traditional function as a training ground for young scientists, a new crop of corrosion specialists for industry may be expected from such work in the course of time.

The work so far indicates that the reaction taking place when copper is placed in water containing oxygen is an oxidation process. The rate of oxidation has been found to depend on the crystallographic orientation, the concentration of oxygen, the presence of CO_2, and the amount of illumination of the oxidizing surface. Further, the source of the above factors determines the nature of the oxide formed, its degree of orientation, and its structural relationship to the copper substrate upon which it grows.

Committee on Electrodeposited Metallic Coatings Meets

The following summary of the February 8–9 semi-annual meeting of American Society for Testing Materials Committee B-8 in the Hotel Benjamin Franklin in Philadelphia was prepared for PLATING by E. B. Saubestre of the chemistry laboratories of Sylvania Electric Products Inc.

Subcommittee I (Specifications):

Chairman—Fielding Ogburn

As a result of balloting, it was voted to return the amendment of A 219-54 (Standard Methods of Test for Local Thickness) to Sub-III for further liaison with Committee A-5.

Section A (Specifications):

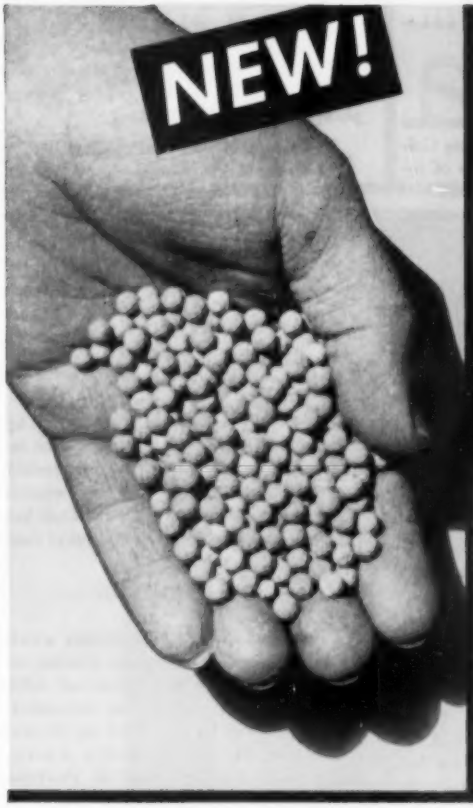
Chairman—W. P. Barrows

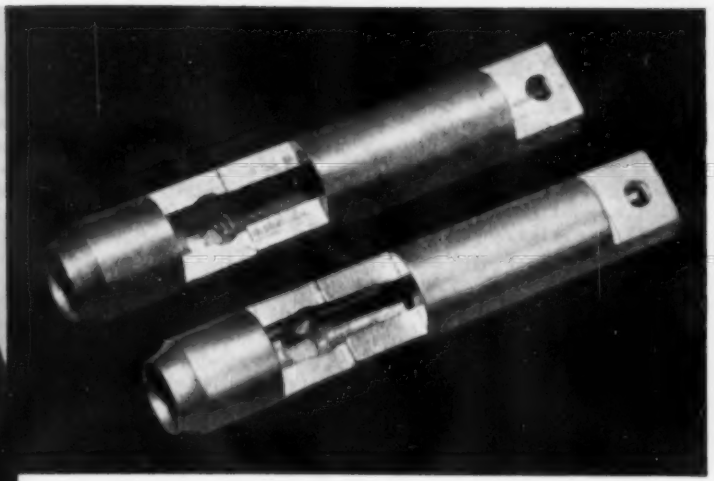
An analysis of 30 ballots shows that most B-8 members favor writing a new ASTM specification covering heavy Ni and Cr deposits. A new section will be set up to do this.

Section B (Definitions):

Chairman—W. H. Safranek

Lists prepared by Drs. Blum and Lowen-





The new ALUNDUM Tumblex "S" abrasive rolls around and through intricate parts; brings high uniformity of radii and surfaces, with smooth finish, to the barrel-finishing of parts as intricate as this gun component. The "before and after" view shows you how the spheres improve external and *internal* areas.

Besides this 3/16" diameter size of Tumblex "S" you can order it in four other sizes, up to 3/8". This means top barrel-finishing performance for you, in many different applications. And these new spheres are exceptionally dense and long-lasting.

Another big advance in barrel-finishing

Norton Tumblex "S" abrasive spheres

From the pioneer of ALUNDUM bonded triangles — now, new bonded spheres to help you do a better job*

If you finish parts that have hard-to-contact recesses or intricate shapes, Tumblex "S" tumbling abrasive is the latest development.

Here are the logical reasons why tubing, coil springs, scissor handles, bearing retainers, pump bodies and many other parts benefit by the new shapes and sizes of Tumblex "S" — and by its top-quality as a tumbling abrasive.

- *Tumblex "S" is made in spheres that easily get into areas where other abrasive shapes can't reach.*
- *It comes in five different diameter sizes. #2, 3/8"; #3, 5/8"; #4, 3/8"; #5, 9/32" and #6, 3/16", covering a big range of parts to be barrel-finished.*
- *Made of famous Norton ALUNDUM abrasive, it cuts fast — resulting in shorter time cycles and lower costs per piece finished.*

Send Your Work Samples

Let us demonstrate in our newly enlarged Sample Processing Department how Tumblex "S" Abrasive can give the value-adding "Touch of Gold" to your product quality and cut your barrel-finishing time and costs. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

G-318

*Trade Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

heim have been consulted in compiling a list of definitions. A new list being prepared for the ASM Handbook will also be considered shortly.

Section C (Electroless Nickel):
Chairman—W. Moline

A monograph is being prepared for publication, covering mention of electroless nickel, chemistry, characteristics of deposits, processing procedures, advantages and limitations, applications, methods of testing, patents, and bibliography.

Task Group (Labeling):
Chairman—E. B. Saubestre

A new group is being formed to investigate the feasibility of labeling plated articles to indicate compliance with ASTM standards.

The nominating committee re-appointed Fielding Ogburn as chairman. In a brief discussion, it was mentioned that new Federal Specifications have eliminated reference to the salt fog test, except in connection with chromate coatings.

Subcommittee II (Performance):
Chairman—W. L. Pinner

Section A (Corrosion):
Chairman—D. M. Bigge

An inspection of the Program 4 Cu-Ni-Cr panels in December showed that ratings made with the simplified Lowenheim method correspond closely to ratings obtained with the standard (Durbin) method. All results obtained to date are highly tentative, owing to the short duration of the program at this point. Some of the effects being included in the study are: Watts vs. bright nickel, Ni vs. Cu strike, effect of heavy Cu undercoat, effect of Cr thickness, buffed vs. unbuffed Watts Ni, ordinary vs. crack-free Cr, effect of Ni thickness.

Section E (Tin):
Chairman—F. G. Lowenheim

A solderability tester has been received and modified. There was a discussion of how to store tin plated panels after plating. It is expected that work on solderability testing will begin shortly.

Section F (Aluminum):
Chairman—J. W. Kerstetter

Exposure of Cu-Ni-Cr plated aluminum panels will be made at Detroit, State College, and Kure Beach. Possibility of including anodized panels was discussed.

The nominating committee re-appointed W. L. Pinner as chairman.

Subcommittee III (Conformance):
Chairman—R. F. Ledford

Section A (Thickness):
Chairman—A. H. Du Rose

Experimental work on the program has been completed, and the data will be analyzed shortly. Methods investigated include Magnegage, Dermatron, and Kocour testers.

Section C (Hardness):
Chairman—N. M. Beckwith

A request was made for assistance in measuring hardness of plated samples. A group on ductility (A. Squitero reporting) reported that Prof. Read has offered assistance. A questionnaire is being sent out to evaluate industry interest in ductility testing.

Section E (Adhesion):
Chairman—B. C. Case

At the suggestion of F. Ogburn, it is proposed that various test methods be mentioned in ASTM Specifications. A section has been set up to do this with R. E. Shaw as chairman.

Section F (Stress):
Chairman—L. Morse

Flat strip and contractometer methods have been studied, and the Stresometer will soon be added to the program. An industry round-robin test is being initiated.

The nominating committee re-appointed R. Ledford as chairman.

Subcommittee IV (Plating Practice):
Chairman—Max Frager

Section K (Cleaning):
Chairman—S. Spring

The monograph on cleaning prior to plating is being revised, prior to submission to B-8.

Section W (Water):
Chairman—H. A. Kafarski

Work has begun with a study of water requirements for cyanide copper plating, phosphating, and chromating.

Task Group (Double Ni coatings):
Chairman—B. Knapp

There was a discussion on the scope of the work of this new group, which will be organized during the coming months.

The nominating committee re-appointed M. Frager as chairman.

Subcommittee V (Organic Coatings):
Chairman—M. Darrin

Section B (Chromated Zinc):
Chairman—A. Mendizza

In testing chromate coatings on zinc by the salt fog test, it was found that the results obtained were markedly dependent upon the amount of salt condensate. Work on anodized aluminum coatings has been held up, pending clarification of conflicts with Committee B-7.

Section F (Organic Finishes):
Chairman—F. L. Scott

An earlier report on the factors which influence adhesion of organic finishes on chromium coatings was approved with one negative vote which was reconciled. This report will be appended to the annual B-8 report. The possibility of eventually publishing this paper in PLATING was discussed.

The chairman announced the appointment of J. D. Thomas as vice chairman and secretary to replace R. D. Miller who resigned due to the press of business.

W. L. Pinner was unanimously re-elected chairman of Subcommittee II upon the recommendation of the nominating committee consisting of F. A. Lowenheim, chairman, C. F. Waite, and W. H. Safranek.

The nominating committee appointed George Best as chairman. The meeting closed with a talk by F. Negley, K. Proctor, and Katz on chromate coatings on zinc. This talk, illustrated with many colored slides, covered recent work by the Bureau of Ships on this subject.

FOR EXTREME FLEXIBILITY with NON-FRAYING, LONG WEAR
FOR HIGH COLOR PLUS GOOD, SOFT-CUTTING ACTION
CENTERLESS (UNSEWED)
UNIT CLOTH BUFF
for more keys to GREATER BUFFING OUTPUT
See pages 376, 434, 438
AMERICAN BUFF COMPANY
2414 South LaSalle Street Chicago 16, Illinois

BEAM-KNODEL CO.
Distributors for
HANSON-VAN WINKLE-MUNNING CO.'S
"PLATEMANSHIP"
A Complete Service for
ELECTROPLATING
POLISHING AND BUFFING
CLEANING AND ANODIZING
CA 6-3956-7 • 195 Lafayette Street, New York 12, N. Y.

LINE OF THE FUTURE DESIGN

SILVER LINE

ENGINEERED FOR THE PLATING INDUSTRY

Introducing the new

ALL-PURPOSE SELENIUM RECTIFIER

For assurance of maximum amperes throughout the entire 2V-12V range, SILVERLINE is the answer with its newly-designed dual-range transformer.

A flip of the switch . . . and SILVERLINE provides maximum amperes for 2V-7V plating needs. Another flip of the switch . . . and SILVERLINE provides maximum amperes for 5V-12V specifications. Both with 5% ripple.

Also, SILVERLINE's improved dial board with 42 positions of control to tap, offers precise regulation . . . exact adjustment.

With assured maximum amperes for greater flexibility to meet practically all plating needs . . . with greater dependability for continuous performance . . . and fully equipped with meters and shunt . . . SILVERLINE is the indispensable all-around Selenium Rectifier for the plating industry.

IMMEDIATE DELIVERY

S | I | L | V | E | R | L | I | N | E

ONE-TENTH BELOW STANDARD PRICE

THE NAMEPLATE THAT MEANS:

"More power to You!"

Pioneers in Selenium Rectifiers

RAPID ELECTRIC CO.

2881 MIDDLETOWN ROAD NEW YORK 61, N. Y. TALMADGE 8-2200

AES NEWS

Francis T. Eddy Heads Technicraft Laboratories

Recently elected president of Technicraft Laboratories, Inc. of Thomaston, Conn. is Francis T. Eddy, first vice president of the AES. He was promoted to the helm of Technicraft from the position of general manager.

A native of Pittsfield, Mass., Mr. Eddy received his degree in chemistry at Brown University in 1937. Before his association with Technicraft, he was superintendent of finishing of the Chase Brass & Copper Company. He was a naval officer during World War II.

A member of the AES since 1938, he was president of the Waterbury Branch, chairman of the New England Regional Meeting and chairman of the Paper Awards Committee before election to the Executive Board.

Taormina Directs Red Cross Campaign

Silvio C. Taormina, president of Platers Research Corp., New York City, was made the chairman for the electroplaters division in the 1957 Red Cross campaign for members and funds for the New York Chapter.

The campaign continued throughout the month of March in an effort to raise $5,500,000 in New York City toward a National Red Cross goal of $95,000,000.

President Heiman Visits Five Western Branches

Five Branches were on the itinerary of President Samuel Heiman's West Coast trip as follows:

March 23—Los Angeles (California) Branch.
March 25—San Francisco (California) Branch.
March 27—Portland (Oregon) Branch.
March 29—Seattle-Puget Sound (Washington) Branch.
March 30—British Columbia (Canada) Branch.

President Heiman not only addressed the Branches on practical plating problems but he also discussed current National Society affairs. "The Slide Story of the AES" was shown at each meeting.

He climaxed his Western Branch tour by installing the British Columbia Branch as a permanent affiliate of the Society as per recent Board action.

St. Joseph's Electroplating Course Tops Capacity

Boasting a registration of 36 individuals at the first meeting, of 47 at the second and 52 at the end of the third meeting the St. Joseph Valley Branch's plating school has been launched with noteworthy success. Having reached the saturation point, registration has therefore had to be closed.

Dr. Harold J. Wiesner, research chemist, Bendix Products Division, Bendix Aviation Corporation, South Bend, Indiana, and a past president of the St. Joseph Valley Branch, is in charge of teaching during the first half of the current school term. He will be followed by Dr. Ernest Wilhelm of Notre Dame. "Principles of Electroplating" by Blum and Hogaboom is the class textbook.

Detroit Branch Forms Ladies Auxiliary

Jan. 4, 1957 will be the memorial date when the Ladies Auxiliary of the Detroit Branch of the AES came into being.

The executive group of the Detroit Branch of AES were hosts to 13 wives of branch members who met for the purpose of establishing a Ladies Auxiliary.

The organization of this group has long been an aim of the Detroit Branch. It has now become a reality.

With the appointment of Sylvia (Mrs. Guy) Cummings as chairman pro-tem and Mabe (Mrs. Donald C.) Austin as secretary-treasurer pro-tem, the Ladies Auxiliary was under way.

The second meeting was held Feb. 1, 1957, with 14 ladies in attendance. The following officers were elected: Betty (Mrs. Howard) McAleer, president; Martha (Mrs. Robert) Dudley, vice president; Elizabeth C. (Mrs. Leslie C.) Borchert, secretary-treasurer.

Since the March meeting of the Detroit AES was Ladies Night, the next meeting of the Auxiliary will be April 5, at which time, bylaws will be acted upon.

Elizabeth C. Borchert

Committee Chairmen at work on plans for the Third Annual Empire State Regional Educational Session. (Left to right) Ken Parnell, Ticket Chairman; R. "Bob" Colvin, Hospitality; V. P. McConnell, Educational Chairman; George W. Cavanaugh, General Chairman; Lindley Wood, Finance Chairman; and Milt Stevenson, Program Chairman.

NATIONAL HEADQUARTERS PERSONNEL

Mrs. Loretta Ehrhardt

Secretary-Assistant to the Advertising Manager, Mrs. Ehrhardt is administrative keystone of the Advertising Department. She is the staff's leader in point of AES longevity exceeding Mrs. Marsh, Office Manager, in this respect by one day.

A Timely Message on

The Sphere of the Purchasing Agent

by Ben P. Sax

Chairman of the Board, American Buff Company

What versions come to your mind when you consider the functions of the Purchasing Agent in any business? Desk man? Work-horse? Efficiency man? Source file? Quality Supervisor? Penny-pincher? Free-spender? Expediter?

Actually, the P.A. is a "combination package" of expert abilities which assure the procurement of the right product, part or system to produce results at lowest cost. Today, business relies ever more heavily upon these men who keep abreast of sources and products which can offset the increasing cost of man-power. New machinery and methods which free costly hands for more essential tasks, and speed or increase output, are significant advances in the fight to reduce overhead.

It takes fine discrimination, based upon wisdom, experience and field knowledge of all markets, products, and supplier dependability . . . plus familiarity with production costs and "purchase price" . . . to decide which actually costs less . . . the purchase that saves in original expenditure, or the higher-cost purchase that produces substantial savings in actual job performance.

Just as our own centerless buff developments have helped the metal finishing industry to multiply its production while substantially reducing costs and man-hours, many other modern products and mechanical brains and hands are being introduced by the P.A. in all fields. In any organization, P.A. is a title to wear proudly.

Sincerely,

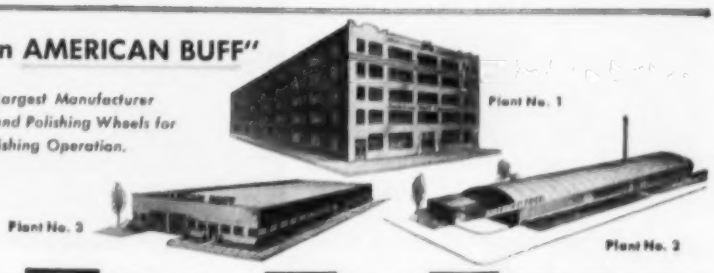
Ben P. Sax

"For the job that's TOUGH—use an AMERICAN BUFF"

BIAS CLOTH • BIAS SISAL • UNIT CLOTH OR SISAL

Patented CENTERLESS Construction
Pat. No. 2,582,506

World's Largest Manufacturer of Buffs and Polishing Wheels for Every Finishing Operation.



American Buff Company
2414 S. La Salle Street Chicago 16, Illinois

AMERICAN BUFFS ARE REGULARLY ADVERTISED IN FORTUNE MAGAZINE

Speaker Helps for Branch Librarians

In a recent issue of the Journal of the American Society of Association Executives, Dr. John H. Frederick, head of the Department of Business Organization at the University of Maryland, presented expert counsel in his article titled "Seeking and Using Good Speakers" that should merit the interest of all Branch Librarians scheduling speakers for Branch functions.

"Musts" for an effective relationship between arranger and speaker, according to Dr. Frederick, are:

1) Give plenty of notice
2) Give plenty of information
3) Ask about his fee
4) Tell him how to get there
5) Advise him of exact place of meeting and arrangements for hotel accommodations
6) Tell him what to wear
7) Ask for publicity information and an advance copy of talk
8) Provide proper facilities
9) Make his introduction brief
10) See that his return transportation is satisfactory
11) Give him, for his wife, any favor or souvenir being provided for the women at the meeting
12) Pay his fee and expenses promptly
13) Send him a letter of thanks together with clippings of any newspaper items about him published.

Empire State Regional Plans Complete

The Third Annual Empire State Regional Meeting will be held at the Onondaga Hotel, Syracuse, N. Y., on Saturday, April 27.

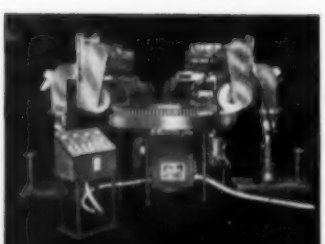
The Educational Session, starting at 2 p.m. will be chairmanned by V. P. McConnell. George W. Cavanaugh, regional chairman, will deliver the address of welcome.

Three speakers are scheduled for the Seminar on New Developments in Metal Finishing: Dr. Abner Brenner, Chief of the Electrodeposition Section, National Bureau of Standards will present a paper titled, "Hydrogen Embrittlement"; Dr. Edward A. Parker, Technical Director, Technic, Inc. is to speak on "Precious Metal Alloy Plating"; a paper "New Developments in Alloy Deposition" will be delivered by Dr. F. A. Lowenheim, Supervisor of Electrochemical Research, Metal and Thermit Corp.; R. A. Stricklen, Research Chemist, Allied Research Products, Inc. speaks on "New Developments in Chemical Treatments for Metals."

Arrangements for the Ladies' Program are under the direction of Mrs. Willard A. Phillips and Mrs. Herbert A. Gerhardt.

The dinner-dance will bring the events of the day to a festive conclusion.

Whatever your finishing requirements may be a PACKER-MATIC is the machine for you. Cost conscious mass producers have recognized the need for high speed, automatic polishing and buffing machines. Let Packer's engineering and developing departments recommend a PACKER-MATIC to meet your demands for faster, more uniform, low cost polishing, buffing and deburring. Send blueprints of parts or samples and we will tell you what PACKER-MATIC can do for you or write for more complete information today.


The finishing touch on cosmetic items is just one of many successful PACKER-MATIC applications.

PACKER-MATIC

THE PACKER MACHINE COMPANY • MERIDEN, CONN.

Pioneer Manufacturers of Automatic Polishing and Buffing Machines

George L. Nankervis

George L. Nankervis, prominent in the metal finishing industry for over 35 years, passed away suddenly on Feb. 13 at the age of 59. He was founder and president of the George L. Nankervis Co., engineers and installers of electroplating facilities.

Mr. Nankervis' career in the industry began in 1922, in Detroit, as a manufacturer's representative, handling many lines of equipment and supplies including Chandeysson Electric and the Meaker Co.

Prior to World War II, Mr. Nankervis began the manufacture of highly specialized plating and anodizing racks, automatic compound applicators and similar equipment for the defense effort. Following the war, he pioneered in the complete engineering and installation of mass production electroplating systems, and in 1946 engineered and installed the then world's largest fully automatic electroplating facility for the Pontiac Motor Division, GMC.

He was a director of the American Ordnance Association, Detroit Branch; a member of the Engineering Society of Detroit, American Electroplaters' Society, the Newcomen Society and past president of the Metal Finishers' Suppliers Assoc. In 1947 he was general chairman of the AES Convention and Industrial Finishing Exposition held in Detroit.

He is survived by his wife, Helen, and a daughter, Mrs. John B. Clippert and two brothers, Russell and Homer.

Another Richardson Allen Engineering "First"

Demonstrating the same unsurpassed initiative, ingenuity and craftsmanship which, over the years, have set the pace of progress for the entire industry. Richardson-Allen engineers —working in close cooperation with Westinghouse engineers— have developed and perfected the ultimate in power rectification.

SILICON

DEPENDABLE POWER RECTIFIERS

HERMETICALLY SEALED JUNCTIONS — HIGH TEMPERATURE OPERATIONS

VERSATILITY—Richardson-Allen silicon rectifiers are now available for the plating and industrial fields in ratings up to 500 kws.

EFFICIENCY—Richardson-Allen silicon rectifier units are now supplying major industries with an unprecedented amount of direct current—with no loss in efficiency, no aging and no apparent limit to the life of the silicon junctions. Single silicon junctions are designed to withstand up to 300 vpi.

ECONOMY — Occupying unbelievable small space, the initial cost is often lower than other conversion methods; practically no maintenance is ever needed and when installation savings and power savings are figured the total amount is impressive.

For additional information, write to:

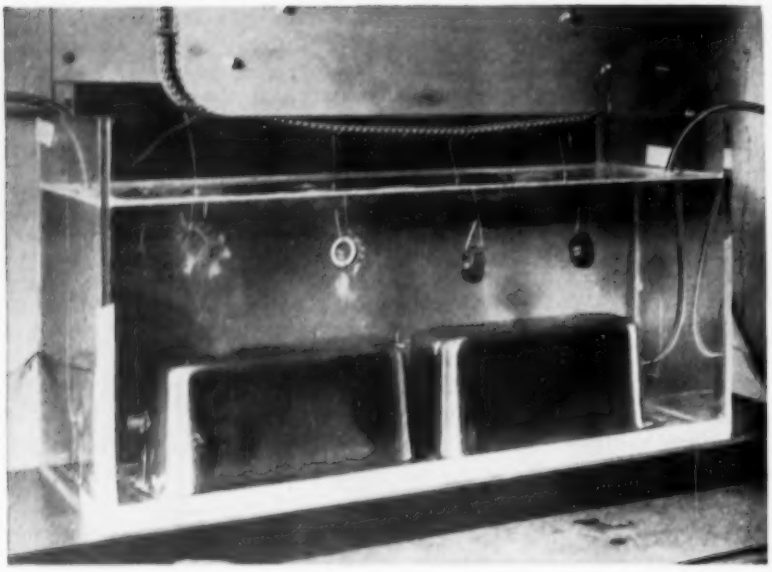
RICHARDSON ALLEN Corporation

DEPENDABLE RECTIFIER SPECIALISTS

a Manufacturing affiliate of

WESLEY BLOCK & CO., INC., 116-15 Fifteenth Ave., College Point, L. I., N. Y.

IN CANADA: Richardson-Allen of Canada, Ltd., 1236 Birchmount Rd., Scarborough, Ontario



Largest Immersion Equipment for Ultrasonic Cleaning by GU

Lowest cost conveyorized automatic ultrasonic cleaning is now practical with these new General Ultrasonics D-52 immersion Sonicells. Each unit provides a full 52 square inches of radiating area, operating at 20,000 cycles for maximum effectiveness.

The improved, customer-tested, D-52 has all-welded stainless steel construction and an exclusive internal design that results in great ruggedness, high efficiency and long life. Groups of D-52's provide efficient and economical operation in tanks and vats of unlimited volume in all the usual cleaning solutions.

These Sonicells are powered in large installations by exclusive GU motor generators for maximum dependability. Smaller installations are powered by our Model 700 and Model 400 electronic generators designed for continuous operations. All controls are simple and easy to operate.

The increased power of these new units has proved highly successful for the most difficult and largest cleaning operations to remove dirt, buffing, grinding and lapping compounds and also to replace hand cleaning operations on blind surfaces.

For further information or demonstration call or write.

GU **THE GENERAL ULTRASONICS COMPANY**

67 Mulberry Street • Hartford 3, Conn.

THE ULTIMATE IN ULTRASONICS

New England Regional Meeting Plans Complete

Ralph H. McCahan of Hartford is the Educational Chairman of the 18th Annual New England Regional Meeting at the Hotel Statler, Hartford, Conn., on April 27.

The speakers are: Dr. Walter Meyer, Enthone, Inc.; Dr. Harry Walker, Noma Hoffman Bearings Corp.; K. P. Bellinger, Conversion Chemical Corp.

Robert Boulay will emcee the ladies afternoon of bingo. Dinner and Dancing will complete the day. Reservations at $6 per person can be made with the Waterbury, Springfield, Bridgeport, Hartford, and New Haven Branch Secretaries.

Carr

Blount

La Manna

Brune

AES Electroplating Courses Committee

The AES Electroplating Courses Committee presently is composed of Dr. Dodd S. Carr, Newark, chairman; Ezra A. Blount, Cincinnati, vice chairman; Flavio J. La Manna, Newark, secretary; Fred G. Brune, Detroit.

The functions of the Committee will include: 1) Fostering new electroplating courses with AES sponsorship; 2) Encouraging the growth of existing courses; 3) Act as a clearing house in exchanging teaching aids to instructors of these courses. These include laboratory experiments, books, exams, visual aids, techniques, etc.; 4) Publicizing class schedules in various journals; 5) Revising the "Plating Course" section of the Branch Officers' Manual when necessary; and 6) Obtaining data on Electroplating Courses given at college levels.

The Committee will appreciate it if members will send information helpful to the project to F. J. La Manna, Bart Laboratories Co., Inc., 227 Main Street, Belleville 9, New Jersey.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 448.

AES Membership Report

Total AES Membership March 1, 1957—7351.

ELECTIONS

Allentown-Reading: M. J. Reider
Baltimore-Washington: R. S. Scheffee
Bridgeport: C. G. Janis
British Columbia: K. Auth, N. D. Colman, W. D. Gould, J. P. Grist, J. W. Hurford, W. A. Kilby, J. Vangoden
Capitol District: H. Leahy, W. McGowan, T. J. Millett, W. Young
Columbus: G. Osterfeld
Dayton: R. D. Fisher, P. N. Garlo, G. C. Hughes, P. F. Inskeep, J. L. Myers, C. Santarello, Jr., I. Tsu
Detroit: J. E. Bunch, E. Dahmer, H. A. Dejarnatt, R. E. Hale, A. Hartung, J. E. Kasper, J. H. Lake, J. T. McWatters, E. G. Nutting, L. B. Schoolmeesters, J. W. Taylor, R. E. Verbick
Hartford: D. Colavecchio, R. M. Jones, W. C. Jones, J. N. Paolantonio, L. V. Szczepanski
Lancaster: C. O. Brandt, W. E. Brandt, Jr.
Los Angeles: R. L. Coombes, D. Morgan, J. J. Phelan, R. J. Swisher, J. A. Weaver
Milwaukee: N. A. Brandt, E. J. Daleiden, F. L. Dousman, H. D. Heutzen, A. P. Lehmann, D. R. Logan, H. H. Pratt, C. H. Rossman, F. A. Sinkler, R. B. Stevens, C. R. Toney, C. C. Vinslauski
Mississippi Valley: G. Halligan, Sr., T. Preston, W. B. Solomon
Montreal: A. P. Copeland, R. G. D. Livick, R. W. Niggeman
Newark: A. Dobbs, R. Duva, W. McMullen
New York: A. Anderson, I. Goldman, S. Lerner, W. Schwartz, C. B. Smith, Jr., A. Trost, Jr.
Philadelphia: P. Karpiak, N. Marable, L. Scarpati, J. L. Stephens
Pittsburgh: J. C. Fugazzi
Providence-Attleboro: P. P. Gyrsting
Rochester: S. Cipporvolo, A. H. King
Saginaw Valley: W. R. Cleary, Jr., C. A. Childers, J. DeWyse, R. M. Parker
St. Joseph Valley: N. E. Lambert, G. W. Shearer, R. H. Trielold
St. Louis: J. Kelly
Southeastern: H. W. Hatley, F. S. Reiff, O. W. Schneider, R. W. Terry, Jr., H. R. Welfare, H. E. Willingham
Syracuse: H. N. Gerhardt, Jr.
Toronto: R. Kyle
Waterbury: T. M. Bauer, C. W. Frizzell, G. O. Jahs, R. Meyers
Member-at-Large: D. J. Fishlock, Bath, England; R. J. Rochat, Geneva, Switzerland

REINSTATEMENTS

Capitol District: W. J. Becker, H. F. Millis, W. O. Naylon
Detroit: H. Bradley, H. L. Boggus, S. J. Cascio, H. A. Lane, A. H. Lovasz, J. R. Otto, E. W. Tuwyea, M. Weinberg
New York: N. Feldman
St. Louis: Dr. H. R. Hanley
Southern Tier: H. R. Harper, K. Stanton, S. C. Stefanski

TRANSFERS

Baltimore-Washington: D. Ernst from Milwaukee
Buffalo: T. A. Todaro from member-at-large
Capitol District: T. Duvall to Syracuse
Detroit: E. Lacy to Houston, C. E. Hunsaker, to Milwaukee; D. Suporta to Chicago; A. E. Weber to Pittsburgh
Milwaukee: C. E. Hunsaker from Detroit
Mississippi Valley: G. Parisho from St. Louis
Montreal: G. Bustard from Western Ontario
Pittsburgh: A. E. Weber from Detroit
St. Joseph Valley: R. Lewis from Grand Rapids
St. Louis: G. Parisho to Mississippi Valley
Southeastern: W. E. Lydick from member-at-large; P. E. Gorse from member-at-large
Syracuse: T. Duvall from Capitol District
Waterbury: R. L. Mitchell from Providence-Attleboro

RESIGNATIONS

Allentown-Reading: W. Weder
Columbus: G. C. Mills
Detroit: Dr. A. DiGiulio, H. J. Jeffers, J. G. Khoury, W. L. McCracken, C. Nielsen, F. Steinhebel
Hartford: A. Carr, B. M. Elliot, F. J. Tarza
Lancaster: L. F. Fox
Sydney: M. J. Sheaffer
Toronto: F. B. Jopson

SUSPENSIONS

Bridgeport: J. D. Tychonich
Hamilton: H. Revill
Lancaster: G. Beck, F. Gearhart, D. Graybill, G. Huefner, F. W. Madden, C. A. McConnell, M. K. Morgan, J. B. Straw, Jr.
Louisville: W. W. Francis, R. McDaniel
New Haven: L. J. Scott
Toronto: T. Clarke, R. P. Crawford, N. C. Davies, J. Dickson, W. K. Huffman, J. Robertson
Waterbury: O. M. Caouette, H. E. Weiss
Wichita: J. Springer

DEATHS

Rochester: G. Rehberg

JUNE Issue is the CONVENTION Issue

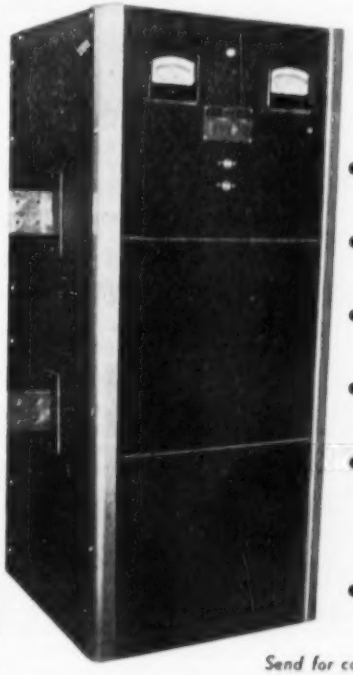
Advertising Forms Close Early

SEELEY
Buffing Compounds

Way Ahead for
Fine Product Finishing

Bar—Liquid—Greaseless

E. E. SEELEY COMPANY INC.
Bridgeport 1, Conn.



- RECTIFIERS AND CONTROLS
- SELENIUM—GERMANIUM
- AUTOMATION SYSTEMS
- CONSTANT VOLTAGE UNITS
- VOLTAGE REGULATORS Manual or Automatic
- TIMING AND PROGRAMMING

Send for complete information

MACARR, inc.
2460 ARTHUR AVE.
NEW YORK 58, N. Y.
WEllington 3-2643

CANDIDATES FOR THIRD VICE PRESIDENT

The candidacy for the Society's national office of Third Vice President was announced, in behalf of the four following noted AES members, at the Interim Meeting of the Supreme Society held in Pittsburgh, Pennsylvania, on January 12, 1957. Expectedly, they will be nominated and vie for election at the Business Meeting of the Supreme Society to be held in Montreal, Canada, Thursday, June 20, 1957.

GEORGE W. CAVANAUGH
Manager of Inorganic Chemistry
Metals and Processes Laboratory
General Electric Company

A native of Syracuse, New York, Mr. Cavanaugh was graduated from Notre Dame University with a PhB degree in 1926. His later graduate studies in the fields of metallurgy and electro-chemistry occurred at St. Bonaventure College, St. Bernard's Seminary and at Syracuse University.

Following three years as a feature writer on the Cleveland News, Mr. Cavanaugh spent ten full years in the metal coating business in Syracuse. He entered the employ of the General Electric Company in 1943 and advanced from metallurgist, welding engineer, then chief chemist to his present position as Manager of Inorganic Chemistry in his company's Materials and Processes Laboratory at Electronics Park, Syracuse.

A long-time member of the AES, Mr. Cavanaugh has a noteworthy record of Society service. He is currently Chairman of the Society's Law Committee and serves as the National Parliamentarian of the Supreme Society. His broad interest and study of parliamentary law since his college days has earned him notice as an authority on the subject. His book, "Simplified Parliamentary Practice," has received acclaim. A member of his company's Speakers' Bureau, he is in demand as a speaker on parliamentary practice by many organizations including AES Branches.

LLOYD O. GILBERT
Supervisor, Metal Finishes Laboratory
Rock Island Arsenal

Born in Davenport, Iowa, Lloyd O. Gilbert is gaining consistently greater respect in AES circles, particularly for sound work as a Branch leader, as a stalwart of AES Research Committee and as a member of this year's Paper Awards Committee. His own technical paper delivered before the 43rd Annual Convention titled "Study of Phosphate Treatment of Metals," was considered by many as one of the high spots of that annual AES assembly.

Mr. Gilbert was educated at Augustana Lutheran College, Rock Island, Illinois, and at St. Ambrose College in Davenport, Iowa. He has been Supervisor in charge of the Metal Finishes Laboratory at the well-known Rock Island Arsenal for the past 17 years. Among other affiliations, he is a member of ASTM Committee B-8; American Ordnance Association Surface Finishes Advisory Committee and the Electrochemical Society. He received a Department of Defense citation for Meritorious Civilian Service. Several patents have been awarded him covering black chrome plating and phosphate coating processes.

He is a founder and current President of the AES's Mississippi Valley Branch and was winner of the Society's Chromium Award in 1953.

DR. EARL J. SERFASS
Head, Department of Chemistry
Lehigh University

A native of Allentown, Pennsylvania, Dr. Serfass earned his BS in 1933, his MS in 1935 and his PhD in 1938, all from Lehigh University. He launched his eminent teaching career at his Alma Mater in 1937 and, by accomplishment in the field of chemistry, rose, step-by-step to head that department in 1952. His broad research activities have included, among many others, the development of instruments for rapid industrial analyses as well as spectrophotometric and colorimetric trace constituent analyses. He is a consultant today to five major industrial companies. He has published some 79 technical articles.

Dr. Serfass possesses a proud record of AES service. He has been Director of Research Project No. 2 since 1945. He has been a National Delegate to the Supreme Society from the Allentown-Reading Branch. He served as Vice Chairman of the Research Committee in 1952–1953, was Chairman in 1953–1955. He was honored with an Award of Merit in 1955.

In addition, he is a distinguished member of the American Chemical Society, The Instrument Society of America, the Optical Society, The American Institute of Physics and the Electrochemical Society. He is a member of Tau Beta Pi and Sigma Xi.

DR. W. ANDREW WESLEY
Manager, Research Laboratory
International Nickel Co., Inc.

Dr. Wesley is a native of Yonkers, N. Y., and received his technical education at Cornell University from which he was graduated with a BS degree in chemistry. He earned his MS degree in 1924 and his PhD degree in 1926 at New York University. College scholastic honors included election to Sigma Xi and Phi Kappa Phi.

Joining the staff of the Research Laboratory of the International Nickel Co., Inc. at Bayonne, New Jersey, in 1926, Dr. Wesley was made head of the chemical research groups working on electroplating and corrosion in 1933. He became assistant director of the Laboratory in 1939 and was promoted to Manager in 1954. He is author of some 40 publications. Some 20 American patents plus corresponding foreign patents have been issued in his name. He is responsible for many contributions to the advancement of the science of nickel plating.

A Fellow of the American Institute of Chemists, his memberships in technical organizations also include the American Chemical Society, the Electrochemical Society, the Armed Forces Chemical Association, the Institute of Metal Finishing, the Research Society of America, and the American Electroplaters' Society. AES honors received include two awards of the AES Gold Medal in 1939 and 1950, the Founders' Gold Medal in 1949, the AES Silver Medal in 1952 and a cash prize in 1943. He received the Hothersall Memorial Medal of the Institute of Metal Finishing, England, 1956.

BRANCH NEWS

Total AES Branches U. S., Canada, Australia, March 1, 1957—55.

BALTIMORE-WASHINGTON

Barrett Discusses Sulfamate Bath

The Jan. 8, 1957 meeting was called to order by President **Horelick** in the Chemistry Lecture Room in the Chemistry Building at the National Bureau of Standards.

Following a short order of business including the election of a new member, the branch enjoyed an entertaining color and sound movie showing many of the ingenious methods employed in the step-by-step construction of the Chesapeake Bay Bridge. This showing was made possible by the courtesy of the Bethlehem Steel Co.

Librarian **Overland** introduced the speaker of the evening, **Richard C. Barrett** of the Barrett Chemical Products Co. Mr. Barrett's topic was "Nickel Plating from the Sulfamate Bath." He began his talk with a brief history of the process and a description of the solutions. He then discussed the pronounced characteristic advantages the sulfamate nickel plating bath has over other conventional nickel plating solutions. These advantages are as follows:

1. **Stress-free deposits**
2. **High current density operation at lower temperatures**
3. **Simplicity of bath composition, control and maintenance**
4. **Low sensitivity to impurities**
5. **Nickel deposits of high chemical purity**
6. **Wide latitude of operating conditions**
7. **Wide range of easily reproduced physical properties of deposit**
8. **Improvement to fatigue strength of underlying base metal**
9. **Excellent grain structure and ductility**
10. **High leveling action for easy buffing**

The question period which followed attested to the interest aroused by his talk.

BRITISH COLUMBIA

Permanent Charter Granted

The Feb. 12 meeting was held at the National Film Board theatre, 535 West Georgia St., Vancouver. Twenty-nine members and guests were present.

The president, **Bill Marquardt,** mentioned receipt of copies of the "Branch Officer's Manual" and also advised the membership that our request for a permanent charter had been granted and that in all probability it would be officially presented to us by the National President on March 29 or 30.

A discussion about the possible donation of books to the new library was referred to a later meeting.

J. Lee discussed the films to be shown which were "No Man Is An Island" from Consolidated Mining & Smelting Co. Ltd. showing various aspects of their smelter in Trail, B.C.; "Motormania" a Walt Disney short on safe driving; and finally "Breakthrough" showing the use of Ingersol-Rand compressors and drills in completing the underground tunnel at Kitimat, B.C. The film originally scheduled "Corrosion in Action" unfortunately did not reach us in time so it will be shown at a later meeting.

CAPITOL DISTRICT

Branch Constitution Changes Approved

The January meeting was held on the 7th at Panetta's Restaurant, Menands, N. Y.

A turkey dinner preceded the business meeting. It was noted that this year the Christmas Party had actually resulted in a slight profit for the treasury rather than the usual heavy deficit.

President **Jack O'Connor** brought up the proposed branch constitution that has been pending. Changes and corrections were made through motions presented and discussed by the members.

1. A motion to change Article II, section 2 to read: If the National Society approves, honorary membership in the Capitol District Branch may be conferred by the majority vote of the members

INDUSTRYS LARGEST PRODUCERS OF LIME BUFFING COMPOUNDS

BRAND New SCHAFFNER C-100

LIME BUFFING COMPOUND

recommended for

MIRROR FINISH ON NICKEL AND COPPER

DRY *and* CLEAN WORKING

Request for SAMPLES on your LETTERHEAD will be honored immediately

WRITE - WIRE OR PHONE - TODAY...

"Schaffner Bros. make things shine"
Bob — Paul — Gus

Schaffner

MANUFACTURING COMPANY, INC.

SCHAFFNER CENTER • ROSEWOOD 1-9902 • EMSWORTH, PITTSBURGH 2, PA.

* TRIPOLI COMPOUNDS * CHROME COLORING ROUGE * GREEN ROUGE * JEWELERS' ROUGE * CROCUS COMPOUND * STAINLESS STEEL COMPOUNDS * ALUMINUM BUFFING COMPOUNDS * ALL-PURPOSE BUFFING COMPOUNDS * WHITE COLORING COMPOUNDS * NICKEL BUFFING (LIME) * EMERY CAKE * PLASTIC BUFFING COMPOUNDS * TALLOW GREASE STICK * PUMICE GREASE STOCK * POLISHING WHEEL CEMENT * STEEL POLISHING COMPOUNDS

COMPOUNDS MADE IN BAR, SPRAY OR PASTE

present at any regular, special, or annual meeting upon any person whose knowledge and service have enhanced the welfare of the Branch. Honorary members shall be exempt from all dues. The motion was approved.

2. A motion to change Article VI, section I to: "The Branch shall hold regular meetings on the first Monday of each month except at the suggestion of the President." The motion was approved.

3. A motion was advanced to establish a procedure for the selection of delegates to the Supreme Society. Article VII section I was to be changed to: "At the meeting prior to the Annual Meeting, the president shall announce that three delegates and three alternates will be selected during the Annual Meeting to represent the Branch. He shall request that all members who plan to attend the National Convention so inform the President before the Annual Meeting. Then, during the Annual Meeting, the President shall select three Delegates and three Alternates from as wide a representation as possible." Article VII, section II was dropped. The motion was approved.

4. A motion to approve the bylaws as amended was seconded and passed.

Bob Wolf, librarian, requested an opinion as to whether the group would prefer a speaker from Behr-Manning, Troy, N. Y. or a tour of their plant for the April 1 meeting. The latter was agreed upon.

A nominating committee was appointed by the president. It included **Ted Infield,** chairman, **Mike Guarneri** and **Chuck Schenk.**

A clambake committee was also chosen with **Tony Fazzone,** chairman. **Chet Klimek** and **Bill Young.**

A motion was proposed to extend an invitation from the branch to **Dave Clarin** to attend whichever of our meetings, including the clambake, that would be most convenient for him, to help show our appreciation for the effort and interest he has contributed to our branch.

Following adjournment, a color film was shown by Bob Wolf on "Fishing in New York State." The film was educational and enjoyable.

E. V. Raymond
Secretary

CAPITOL

Eddy Addresses Branch; Outing Date Set

The February meeting was held Monday, the 4th, at The Center Inn, Albany, N. Y. Here, a ham steak dinner was enjoyed by 19 members and guests.

Our speaker for the evening was **Francis T. Eddy** of Technicraft Laboratories, Inc., and first vice president of the National Society. Mr. Eddy spoke on the Pittsburgh Interim Meeting and the organization of the National Society.

Among the things discussed at the Pittsburgh meeting and reported by Mr. Eddy were: the possibility of increasing national dues; that the Educational Committee carry over for more than one year; and a proposed revision of the Society's national constitution.

Mr. Eddy mentioned ways to increase interest at the local meeting. He mentioned that book reviews, talks on organic finishing, and having members as speakers have worked well at various branches in recent years.

To the best of my knowledge, Mr. Eddy was the first speaker at our branch ever to bring his wife with him—which we appreciated.

A short business meeting was held. **Mr. Wolf,** librarian, announced plans for the Behr-Manning Plant tour on April 1. A date was set by the picnic committee for the annual outing—June 1, a Saturday.

E. V. Raymond
Secretary

CENTRAL MICHIGAN

Head Speaks on Electroplating

The Central Michigan Branch met on Feb. 12 at the Porter Hotel in Lansing. The business meeting, opened by President **G. S. Woodruff** concerned the coming election of officers, and a discussion of possible changes in meeting nights and locations.

ALL PURPOSE CUT AND COLOR
TRIPOLI BUFFING COMPOUND
NON FERROUS METALS

BRAND NEW
Schaffner
TRIPOLI T-300

BILT-IN CLEANING AID

Write in for your FREE SAMPLE BAR....
Test this NEW compound in your Plant
at OUR EXPENSE....

Request for SAMPLES on your LETTERHEAD
will be honored immediately.

WRITE WIRE OR PHONE TODAY

"Schaffner Bros. make things shine"
Bob — Paul — Gus

Schaffner
MANUFACTURING COMPANY, INC.
SCHAFFNER CENTER • ROSEWOOD 1-9902 • EMSWORTH, PITTSBURGH 2, PA.

* TRIPOLI COMPOUNDS * CHROME COLORING ROUGE * GREEN ROUGE * JEWELERS' ROUGE
* CROCUS COMPOUND * STAINLESS STEEL COMPOUNDS * ALUMINUM BUFFING COMPOUNDS
* ALL-PURPOSE BUFFING COMPOUNDS * WHITE COLORING COMPOUNDS * NICKEL BUFFING (LIME) * EMERY CAKE * PLASTIC BUFFING COMPOUNDS * TALLOW GREASE STICK
* PUMICE GREASE STOCK * POLISHING WHEEL CEMENT * STEEL POLISHING COMPOUNDS

COMPOUNDS MADE IN BAR, SPRAY OR PASTE

The speaker for the evening was the National second vice president, **Herberth E. Head,** of the Chrysler Corporation, whose subject was "Electroplating on Stainless Steel." Because of the excellence of the presentation and the interest in the subject in this automobile-trim conscious area of Michigan, the lively discussion and social hour continued for hours.

Earl D. Creese
Publicity Secretary

CHICAGO

Annual Educational Session and Banquet

The 45th educational session and banquet was held at the Conrad Hilton Hotel on Saturday, January 26, 1957. The executive secretary of the National Society, **John P. Nichols,** was officially introduced to the Chicago Branch. Among the guests were **Herberth Head** and **Ralph Wysong** of the National Society and **Peter Kovatis,** secretary of the National Association of Metal Finishers.

Three timely and interesting papers were presented in the afternoon session. They were as follows:

1. "Structural Materials in Reactor Design." **Dr. J. H. Monaweek,** associate chemical engineer, Argonne National Laboratories.

Dr. Monaweek received his Ph.D. from the University of Michigan and after fifteen years of job-shop experience as owner and operator, he accepted a teaching assignment in the engineering department at Michigan. He has been associated with the Argonne National Laboratories for the past seven years.

Dr. Monaweek described some of the materials that are used to construct atomic reactors. He also discussed the types of plating used as well as the conditions the plating must withstand.

2. "Gas Plating." **Malvern J. Hiler**—president, Commonwealth Engineering Co.

Mr. Hiler is a graduate of Michigan State Normal College. He has wide experience in administration, sales, research and development work. The paper covered the equipment and the reactions involved in depositing metal from the gas phase rather than from electrolysis such as is normally done in electroplating. The compounds generally used are the carbonyls of nickel, iron, and other metals. An interesting fact pointed out was the speed of deposition of metals by this process.

3. "Hydrogen Embrittlement." **Dr. L. D. McGraw,** assistant chief, Electrochemical Engineering Division, Battelle Memorial Institute.

Dr. McGraw is a graduate of St. Thomas and received his Doctorate at Carnegie Institute of Technology, specializing in the field of physical chemistry. Following teaching experience at St. Louis University, he joined the staff of Battelle Institute in 1948. This paper covered a discussion of mechanism for the entry of hydrogen into basic metals, the measurements of hydrogen damage, and the relief of embrittlement.

The technical sessions were very well attended and proved to be profitable to all. The day came to a close with the annual banquet, enjoyed by all the 1100 persons present.

J. C. Corre
Publicity Chairman

CHICAGO

Huzucha Has Not Missed Meeting in 42 Years

The regular monthly business and technical meeting was held Friday, Feb. 8, at the Western Society of Engineers.

The general subject for the evening was "Conversion Coatings." Our first speaker, **Rudy Huzucha** of the Clinton Co., discussed "Organic Finishes" with respect to plating. An old time member of the Chicago Branch, he has distinguished himself by not missing a meeting in 42 years. He was given a Meritorious Service Award by the society last year. His many years of working in plating rooms has given him much practical experience in lacquer techniques related to plating. Rudy discussed water-dip lacquers, precipitating thinners, and lacquers for brass finishes. This informative discussion was concluded by a very interesting question and answer period.

Our second speaker of the evening was our own **Dr. R. E. Harr** of the Western Electric Co. and president of the Chicago Branch. Dr. Harr is also a member of the Research Committee, and the Editorial Board of PLATING. He discussed the Evaluation Studies made by ASTM on zinc plated panels treated with various types of chromate films. A series of colored slides was used to show the appearance of the above panels after the exposure periods. He pointed out that

PHELPS DODGE REFINING CORP.

Serves the Plating Industry with:

TRIANGLE BRAND
COPPER SULPHATE

TRIANGLE BRAND
NICKEL SULPHATE

PHELPS DODGE REFINING CORP.

300 Park Avenue, New York 22, N. Y. • 5310 West 66th Street, Chicago 38, Ill.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 463.

Impulse sales — plus wearability and beauty are built into these well designed, embossed metal cabinets. They sell on sight . . . and they're scuff-proof and colorful. Toughness and beauty combine to add new dimensions in profits for their manufacturer.

Built-in by

REYNOSOL

Organisol-plastisol coatings by Reynolds make improvements or new developments possible for products manufactured of

- Glass
- Fabric
- Paper
- Wood
- Metal

Makers of both industrial and consumer goods the country over are successfully using Reynosol — proved Reynolds plastisol coating — in many different forms: in different colors, with various characteristics "tailored" to different needs, and often custom-formulated for unusual jobs.

Reynolds exceptional research and consultation facilities are at your complete disposal.

Regardless of the materials which comprise your products, why not consult Reynolds for your coating needs.

Member Vinyl Dispersion Division, SPI

REYNOLDS CHEMICAL PRODUCTS COMPANY

ANN ARBOR, MICHIGAN

DIVISION OF STUDNITZ GREENE CORP.

this work was in its preliminary stages and that an attempt is to be made to correlate these exposure results with those obtainable in accelerated corrosion tests.

The meeting was well attended and proved to be informative. The Chicago Branch considers itself very fortunate to have members capable of such an outstanding performance.

J. C. Corre
Publicity Chairman

CINCINNATI
Korbelak Discusses Precious Metal Plating

The meeting on Feb. 27 was called to order by President **Roof** with 37 members and guests present.

Will Loveless reported that the Membership Committee is completing its plans for the membership drive.

President Roof appointed to the nominating committee: **Bob Miller, Ezra Blount, Aubrey Holt, Russ Waters, Stewart Chipman** and **Bill Gordon.**

The following men were appointed as delegates and alternates to the National Convention: Delegates—**William Stephenson,** Wilson Loveless, Ezra Blount. Alternates—**Chuck Wise,** Bob Miller, **Don Gusse.**

The speaker for the evening was **Al Korbelak** of the Sel-Rex Corporation. Mr. Korbelak discussed "Precious Metal Plating" and in particular bright gold plating. He pointed out many of the advantages of gold plating over gold filling in the jewelry field. Many samples of bright gold plating were exhibited.

After a question and answer period, the group adjourned for the social hour sponsored by **Harvie Johnson** of the Belke Manufacturing Co.

D. L. Kaplan
Secretary

COLUMBUS
Want Tri State Meeting in 1958

The regular monthly meeting of the Columbus Branch was held at Battelle Memorial Institute on Friday, Feb. 1, 1957.

The business meeting was called to order by President **Bill Shriver.**

Treasurer **Bill Hespenheide** submitted his resignation because he is accepting a position with Burroughs Corp. in the Philadelphia area.

Tri-State committee member **Doug Gordon** told of the coming Tri-State meeting at French Lick, Indiana on March 30, 1957.

The Tri-State delegates were instructed that the Columbus Branch wants a Tri-State meeting held in 1958.

A motion was made, seconded and approved that the Columbus branch meetings should start at 8:00 p.m. promptly.

A new member was elected.

Harry Moore was nominated for treasurer, and elected.

Librarian **George Skelly** introduced the speaker of the evening, **Fred Arndt** of Heil Processing Co. of Cleveland, Ohio whose subject was "Ventilation in the Plating Room." Mr. Arndt gave an interesting talk on the design of various ventilating systems for the plating room.

Halvor S. Christianson

DAYTON
Nominating Committee Named; 7 New Members

The Dayton Branch held their regular meeting, Feb. 20 at the Hotel Biltmore with 30 in attendance.

Seven new members were accepted into the Branch.

Chairman **Bob Ruleff** appointed to the nominating committee for the coming elections **Fred Bauch, John Easton** and **Frank Klein.**

Delegates and Alternates elected were **Jack Baker,** John Easton, R. L. Ruleff, **Bennie Cohen, Byron Bowman** and **Holle Luechauer.**

The speaker for the evening was **W. K. Murray,** chemical engineer, Enthone, Inc., New Haven, Conn. and his paper was "Stripping of Electrodeposits." This proved to be an interesting and informative presentation.

Refreshments after the meeting were through the courtesy of the R. O. Hull Co., and their local representative and Dayton Branch member, **L. A. Critchfield. Mr. Rhodes** of the Cleveland office of Enthone, was a guest.

R. M. Clinehens
Secretary

DETROIT
Officers Nominated; Head Talks on Society Structure

The January meeting was held in the Sheraton-Cadillac Hotel's Founders' Room on Friday, Jan. 4, 1957. The meeting opened with a film entitled, "Horizons Unlimited."

Howard McAleer, president, officially welcomed the assembled members and read a letter from **John P. Nichols,** executive secretary of the National Society, thanking the Branch for the good time he had at the Annual Christmas party.

Ed Kubis, secretary-treasurer, reported on a letter from the National Society urging every member to fill out the card which will be sent out as a survey of the membership needed for the audit of the Audit Bureau of Circulations.

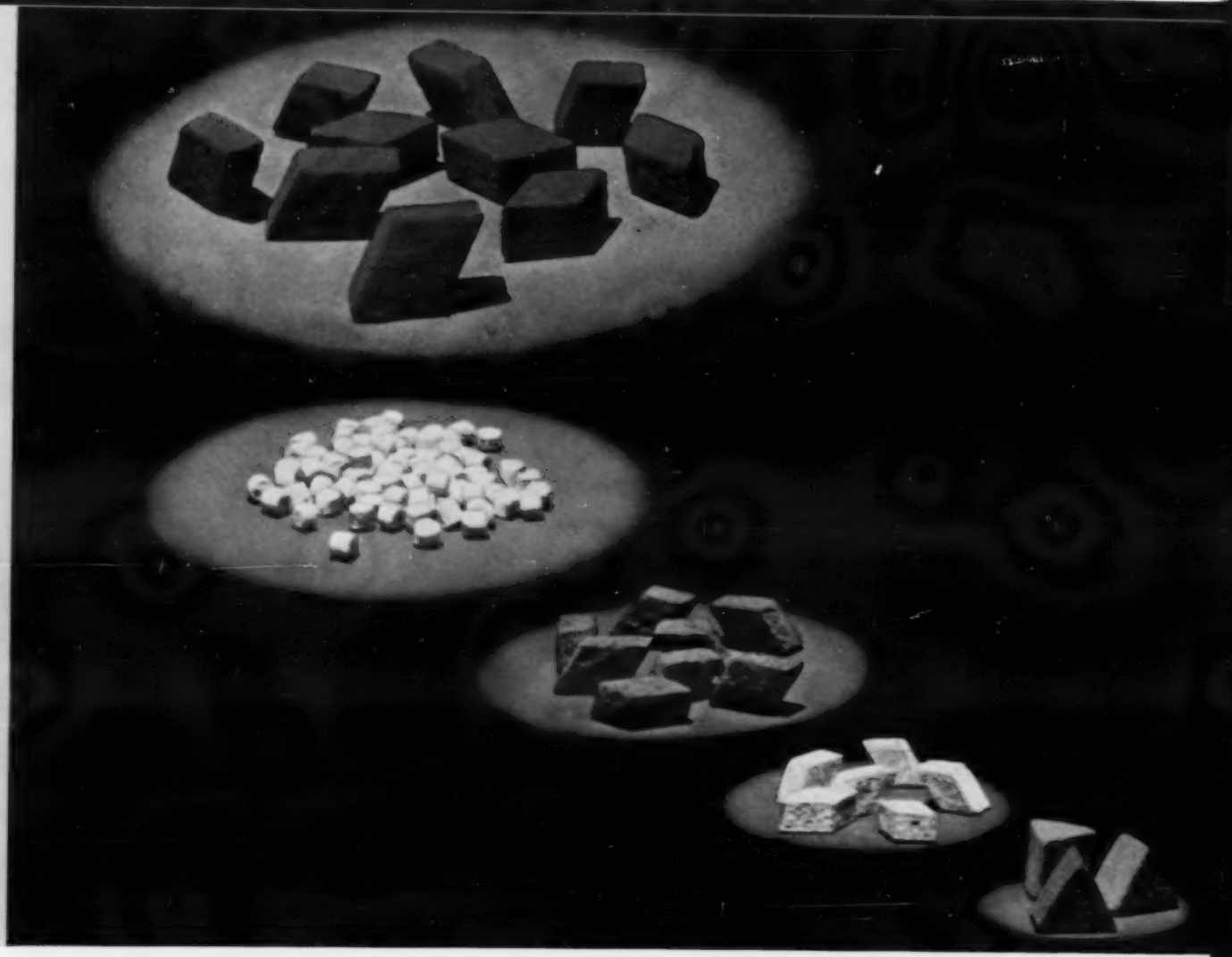
Ed Kubis introduced seven new members. He also announced the dates of the annual parties for the Cleveland and Chicago branches.

Walter Pinner, chairman of the nominating committee, announced the names of the nominees for the coming annual election:

President, **C. H. Friedt Jr.;** 1st Vice President, **Manuel Ben;** 2nd Vice President, **Donald Bigge;** Secretary-Treasurer, **E. J. Kubis;** Educational Chairman, **J.**

For The Business End of your Tumbling Barrel

New developments in abrasive media have consistently come from CARBORUNDUM to set the standards for tumbling performance everywhere. *Bonded tumbling media,* for example, with controlled and absolute uniformity of shape and size, now permit predictable results on every tumbling job—deburring, scale removal, polishing, honing, blending, and scores of other operations. For abrasive answers to your tumbling-job problems, see your Carborundum Distributor or Salesman. Or write The Carborundum Company, Niagara Falls, New York, and ask for Booklet A-1461. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.



Ask the man from **CARBORUNDUM** REGISTERED TRADE MARK **ELECTRO MINERALS DIVISION**

CARBORUNDUM ••• **also makers of a complete line of Bonded and Coated abrasives**

% purity

CrO_3 . . . . . 99.75% MIN. SO_4 . . . . . 0.1% MAX.

When a commercial chemical runs 99.75% pure, the user need not ordinarily concern himself about the remaining 0.25%. In chromium plating, however, the 0.25% is important because it includes whatever sulfate is present.

While the maximum amount of sulfate permitted in Mutual Chromic Acid is only 0.1%, average production is well below that figure. Furthermore, the sulfate content varies but little from drum to drum. No other impurity exceeds 0.01%. The balance represents a trace of moisture which, of course, is harmless. This close attention to small details is one reason for the wide acceptance of the Mutual label wherever quality chromium plating is performed.

Sodium Bichromate • Chromic Acid • Potassium Bichromate

MUTUAL CHEMICAL DIVISION

MUTUAL — ALLIED CHEMICAL & DYE CORPORATION

99 PARK AVENUE • NEW YORK 16, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE B 406.

D. Thomas; Board of Managers, **John Siefen.** Nominations from the floor can be made at the February meeting.

Accolades to **Wright Wilson** for the annual Christmas Party. This was from all reports one of the most successful and entertaining parties to date.

Cleve Nixon, General Motors Research Staff, introduced the speaker of the evening, **Herberth Head** of Chrysler Corporation.

Mr. Head, in his dry Kentucky-type humor, gave a very interesting talk on the structure and functions of the National Society.

Patrick J. Driscoll

DETROIT

Bechtel Tells of 50 Years of Plating

The February meeting of the Detroit Branch was held in the Founders' Room of the Sheraton-Cadillac Hotel on Feb. 1, 1957.

President **Howard McAleer** opened the meeting. He asked for nominations from the floor for the coming elections. As none were forthcoming, the nominations were closed. The National Society has appointed **Manuel Ben** as vice chairman of the 1959 convention.

Clarence DeGrote was appointed editor of the "Scoop" sheet which will accompany the meeting notices from now on. He will report on local color, personalities and production of members individually or company-wise of the Detroit Branch.

As usual, **John Hitchcock** was appointed chairman of the Tellers Committee for the coming election. I believe he has a monopoly on this task.

Educational chairman, **Doug Thomas,** announced that the March meeting will be Ladies Night. Speaker of the evening will be **Robert DeVor** of the DuPont Co. His topic will be, "Progress Must be Created."

Bert Lewis, president of the Northwest Chemical Co., welcomed the old timers as this meeting was in their honor. He also introduced **Ernest Bechtel,** speaker of the evening.

Mr. Bechtel's speech, "The Development of Plating since 1907" was very reminiscent for many of the 200 members in attendance.

Patrick J. Driscoll

HARTFORD

Kushner Speaks on "Rinsing and Water Control"

The regular Branch meeting was held on Feb. 18 at the Bond Hotel; 60 members and guests were present. Preceding the meeting a movie in color entitled "Bright Steel" was shown. Following the movie **Armand Faucher** presented "New Developments."

The guest speaker for the evening was **Joseph B. Kushner** of the Joseph B. Kushner Electroplating School whose subject was "Rinsing and Water Control."

Plated under vacuum, these articles have a high-sheen surface that lasts as long as conventionally plated pieces.

Why plating
with vacuum
is easier and more profitable

Without buffing or polishing, without corrosive cleaning baths, without highly skilled help, you can now cover articles like those shown above with a shimmering finish that lasts for years.

All it takes is a CEC vacuum coater and some inexpensive lacquers to make metal and plastic articles look silver, gold, copper, or a multitude of other colors and tones.

Vacuum-plating costs less. With a CEC vacuum coater you can plate thousands of pieces per day with unskilled labor.

New longer-lasting lacquers. There are on the market many lacquers which can make vacuum-plated articles wear as well as those plated in conventional ways.

The stayfast finish requires no retouching, or buffing, or polishing—just an easily applied coat of lacquer.

You can control film thickness easily and precisely. You can make surfaces electrically conductive *or* insulating as you wish.

For further information on this highly profitable process, write for information on the coaters, the lacquers, and the methods used.

1450 2½" diameter pieces per cycle, 3 to 6 cycles an hour—that's the production rate of this 48" CEC vacuum coater.

Consolidated Electrodynamics
Rochester Division, Rochester 3, N. Y.
formerly Consolidated Vacuum

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 456.

Mr. Kushner pointed out two good reasons for conserving rinse water in the plating room (1) Rinse water is becoming scarcer and more costly and (2) The more rinse water being used the more waste water has to be treated where stream pollution is critical. Water is becoming scarcer because of greater demand for it (air conditioning and population increase are only two reasons); therefore, water rates are going up. Mr. Kushner pointed out factors affecting solution dragout as: use of less concentrated baths, higher temperatures, wetting agents in the baths, insulated racks, racking methods, rate of transfer from bath to rinse tank and use of reclaim rinse tank. To conserve water and for better rinsing, multiple tanks were suggested, use of agitation, spray and flood rinsing and various gadgets on the rinse tank to control water flow and control the concentration of salts in the rinse water.

The technical chairman for the evening was **Ralph McCahan.**

Stanley Platoz
Secretary

LANCASTER
Electroless Nickel Plating Presented by Metheny

The Feb. 8 meeting was called to order by Vice President **Curvin Miller** at the Stevens Trade School, with 32 members present.

Two applications for membership were presented.

The nominating committee appointed comprised **Charles Snyder, William Fordney** and **Hal Kilheffer.**

The program consisted of an illustrated talk by **Donald E. Metheny** of the General American Transportation Co. on "Electroless Nickel Plating by the Kanigen Process." A brief history of electroless nickel plating was covered which lead into the processing techniques of the Kanigen Method. Detailed description on types of plating and physical properties obtained was presented. A question and answer period followed the discussion.

G. S. Wells
Secretary-Treasurer

LOS ANGELES
Charter Members Form Panel of Experts

The February meeting was held on the 13th at Rodger Young Auditorium in Los Angeles. Attended by 85 members and guests, this meeting was designated as "Charter Members Night."

After President **Truman Stoner** brought the meeting to order and the usual preliminary business matters were discussed, **Stuart Krentel,** a member of the nominating committee, announced the nominees for the 1957-58 term of office:

President, **George Magurean;** 1st Vice President, **Norman McEwan;** 2nd Vice President, **George Hetz;** Secretary, **Emmett Babcock;** Treasurer, **Harvey Hunt;** Librarian, **Frank Virgil.**

Board of Managers: **Truman Stoner, Earl Arnold, Ed Wells.**

Voting will take place at the March meeting.

In lieu of our regular technical session, and in keeping in line with the theme of this meeting, a special program honoring our original charter members was conducted by **Earl Coffin,** an active charter member. Mr. Coffin introduced and gave a brief history of each charter member present. The honored guests were: **Don Bedwell, Harold Coombes, Bernie C. Gardes, John Merigold, E. P. Robinson, Ray Vasquez.**

These gentlemen were set up as a panel of experts. The topic of the evening was "Plating Practices, Past and Present." It brought about a lively discussion from the floor with shades of humor and touches of educational value. Such old plating practices as salt water gold solution, buffed dull nickel, and ways and means of pricing a job in the old days ("Get what you can outa the customer") were discussed versus today's modern methods on gold, bright nickel, copper, brass, etc., and modern shop practices.

All in all, it was a very enjoyable session for the old timers as well as the newcomers, with many memories revived and lots of interest created. A standing ovation was given to each charter member as a tribute to their contribution to the growth of our branch—27 years old! **Frank Virgil**
Secretary

Eliminate Rhodium Plate Rejects!

Sel-Rex RHODEX

produces compressively stressed deposits

assuring crack-free, peel-free service. Here's proof! The photograph demonstrates the high tensile stress of conventional rhodium electroplate and the CS of RHODEX. Dissolving the basic metal caused the conventional rhodium electroplate to disintegrate into small crystalline flakes. The Sel-Rex RHODEX electroplate remained unimpaired, and in a continuous film. RHODEX does not peel or crack regardless of thickness! Write for details.

Precious Metals Division
SEL-REX CORPORATION
155 Manchester Place, Newark, N. J.

Offices: Detroit—Chicago—Los Angeles

The NEW "Spher-O-FORGED" COPPER BALL ANODE

ADVANTAGES:

- 10 to 20% more weight. Last longer
- Pure electrolytic copper
- Require less frequent replacement
- Smooth, clean, bright surface
- Cold-forged—uniformly dense
- More even plating; save you money

We can also furnish flat rolled and oval wrought; cast oval, flat and flat-top; and electro-deposited anodes.

Write for FREE sample, prices and literature.

CHASE BRASS & COPPER CO.
—Incorporated—
Subsidiary of Kennecott Copper Corporation
WATERBURY 20, CONN.

LOUISVILLE

Meeting Place to Be Changed

The regular monthly meeting was held Thursday, Jan. 17, 1957 at Kapfhammer's Party House, 1506 South Shelby St., Louisville, with a dinner served at 6:30 p.m. President **K. C. Reifsteck** opened the business and open meeting at 8:00 with 24 members and guests present.

The Sick Committee reported that Secretary and Treasurer **J. G. Sterling** had entered the hospital for an examination.

Technical sessions chairman, **John S. Houston,** reported that the February meeting speaker will be **Mel Fogg** of the Globe Chemical Co., on the subject "Copper-Tin Alloy Plating."

A letter was received and read from the ticket distribution chairman of the Tri-State Regional committee, Indianapolis Branch. The Louisville Branch received 200 tickets to the Tri-State Party at French Lick on March 30.

The Committee appointed to investigate a different monthly meeting location reported two favorable sites—Bauer's Restaurant on Brownsboro Road and the White Cottage on Bardstown Road. A motion was made by **Frank Wilcher** and seconded by **Jim Smith** that the April and May meetings be held at these sites respectively so that the branch members could decide on the future meeting place. The motion was passed.

Harold Smith inquired whether the Louisville Branch was a member of the Louisville Engineering Society. He was asked to report on the requirements for membership at the next meeting.

Marv Steuernagel of the Indianapolis Branch reported on the latest Tri-State plans.

President **K. C. Reifsteck** appointed a nominating committee composed of **A. A. Oertel,** chairman, **S. J. Beyer, James Smith** and **R. G. Marshall** to select candidates for branch offices for the coming year.

President Reifsteck turned the meeting over to Technical Sessions Chairman J. S. Houston who introduced the speaker **C. W. Ostrander,** service manager for Allied Research Products, Inc., Baltimore. An interesting talk supplemented by colored slides followed on the subject of "Chromate Conversion Coatings." The first coatings were produced and patented in 1936 and since then they have found wide use as a paint base and corrosion protection to non ferrous metals. A lively discussion followed and Mr. Ostrander was given a rising vote of thanks.

R. J. Marshall
2nd Vice President
and Acting Secretary

MILWAUKEE

Dual Educational Sessions; 9 New Members

The 476th regular meeting of the Milwaukee Branch was called to order by President **Herman Tessman** on Feb. 1, 1957, at the Ambassador Hotel with 98 members and guests present.

E. H. McCoy submitted a report of the membership committee in which he congratulated the members on their activity in obtaining new candidates for membership in the Branch.

Twelve applicants for membership were presented and elected.

Fred Anderson stated that a meeting of the Annual Meeting Committee was scheduled for Feb. 9. The following members of the committee were requested to be present:

H. Bornitzke, R. Steuernagel, L. Diveley, E. Robinson, P. Ritzenthaler, F. Marshall, C. Peter, G. Einberger, G. Schwemer.

An Organic Finishing Committee report was provided by **C. Doria** who indicated that things were going well and that members were to report their feelings and give their suggestions to him. **John Wagner, Howard Weiley** or **Ben Coughlin.**

A report on the Interim Meeting at Pittsburgh was presented by delegates P. Ritzenthaler and L. Diveley.

Phil Ritzenthaler, chairman of the research committee welcomed the Square D Company into the family of Sustaining Members and announced that the March 1 meeting would be Sustaining Member Night.

Leslie Diveley, program chairman, presented the speakers of the evening.

Organic Section: **Harris Beck**—Glidden Co.—"Causes and Cures of Some Common defects in Paint Films."

Inorganic Section: **Richard C. Barrett**—Barrett Chemical Products Co.—New Developments in Cadmium Plating and "What Happens in A Plating Barrel."

MISSISSIPPI VALLEY

Electroplating Course; Exchange of Speakers

The January meeting was held at the

Outstanding Performers...
PLASTISOLS FOR COATING PLATING EQUIPMENT
STOP-OFF COATINGS
STANLEY PLASTISOLS — for coating racks, tanks, conveyor hooks, baskets and other materials handling equipment. They offer . . . toughness; exceptional adhesion; chemical, abrasion and corrosion resistance; durability and other advantages. Custom-Formulated to your specific needs.
STANLEY STOP-OFF COATINGS — for brushing or spraying. They keep the plating where you want it, prevent creepage, will withstand prolonged immersion in acid or alkaline solutions at room or raised temperatures. Are removed easily.
Write for our Idea file folder, "Stanley PLASTISOLutions," and data sheets on Stop-Off Synthetics and 77X-1078 Chemical Resistant Plastisol.
STANLEY
PLASTISOLUTIONS
STANLEY CHEMICAL COMPANY*
Subsidiary of The Stanley Works
DEPT. D, 1508 BERLIN STREET, EAST BERLIN, CONN.
*Member, Vinyl Dispersions Division, S.P.I.
STANLEY
See Stanley first for finishes that last
LACQUERS • SYNTHETICS
VINYLS • ENAMELS
STANLEY TOOLS • STANLEY HARDWARE • STANLEY ELECTRIC TOOLS
STANLEY-JUDD DRAPERY HARDWARE • STANLEY STEEL STRAPPING

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 458.

Moline Legion Hall on Wednesday, the 23rd, with **B. J. Nordblom,** 2nd vice president, as chairman.

The chair stated that **Dr. Dalton** of St. Ambrose College was present to explain a course in electroplating which the college will offer.

Stanley Baker of the Pioneer Division of Bendix Aviation Corp., Davenport, Iowa introduced the speaker. Dr. Dalton explained the proposed course by saying that it will cover those basic concepts of chemistry and physics pertaining to electrodeposition. The total cost of the course is $65 per person a semester. It will be a four-hour course meeting two nights a week. No prerequisites are required, and no college credit will be given. The course would start Feb. 4. A minimum enrollment of 10 students is required.

John Hartman asked if anyone had explored the possibility of getting state help to defray part of expense of such a course.

Paul Gardner pointed out that it is sometimes difficult for a man to devote two nights a week to such an activity, and asked if it would be possible to meet only once a week. Mr. Gardner also felt the $65 charge excessive.

J. H. Berg pointed out that in his opinion the cost was not excessive since the information to be derived from the course was so pertinent to the plater's everyday work.

The chair asked for a show of hands of those persons wishing to enroll in such a course. Six persons responded.

An interesting film, produced by the De Vilbiss Co., was shown. It dealt with spray painting and the maintenance of spray equipment.

Bernard Nordblom announced that at the February meeting a nominating committee will be appointed for the selection of candidates for officers for the coming fiscal year.

Tom Brennan of the Rockwood Branch announced that a discussion had been held at that Branch regarding the exchange of speakers with our Branch.

It was announced that Lloyd Gilbert had been nominated as a candidate for 3rd Vice President of the National Society at the meeting in Pittsburgh. It was also announced that the Postmaster General had expressed a willingness to issue a commemorative postage stamp in honor of the 50th anniversary of the AES.

Paul G. Chamberlain
Secretary-Treasurer

MISSISSIPPI VALLEY
Morris Presents Paper on Zinc Plating

The February meeting of the Mississippi Valley Branch was held on the 20th at the Moline Illinois American Legion Hall. The meeting was preceded by a chicken dinner which was attended by 26 persons. A total of 42 attended the meeting.

The meeting was called to order by President **L. O. Gilbert.**

John Hartman, librarian introduced **Don Morris** of Hanson-Van Winkle-Munning Co. whose subject was "Zinc Plating." He described acid zinc plating, its operation and application and talked in more detail on cyanide zinc plating. He pointed out that the maintenance operation of sodium cyanide to zinc metal of 2.4 to 3.0 is of prime importance. Also that too much cyanide causes excessive gassing, fourning, blistering and narrowing of bright range. Too much caustic (an excess of 18 oz/gal) causes blistering. Some organic brighteners are not stable above 95 F. Most metal contaminates may be eliminated by maintaining an excess of sulfide or polysulfide in the bath. Copper must be removed by zinc dusting. Residual sulfide may be determined by the addition of a dilute lead acetate solution to a small amount of the bath solution. A brown precipitate indicates an excess. Also described was the use of subsequent bright dips.

A film was shown entitled "Metallizing, Its Practical Application" it was prepared by Metco.

The chair appointed a nomination committee for selection of officers for the coming year. It consists of **Stanley Baker, Al Denhart, Vincent Halgren** and **Art Jackson.**

Lloyd Dunn of the Chicago Branch

USE READER SERVICE CARD; INDICATE A 459.

Used by Platers, Silversmiths, Jewelry Manufacturers, Makers of Watches, Clocks and Electronics and other metal finishers.
Supplied in straight or crimped brass, steel or nickel silver wire in sizes .0025 to .006
Also available in Stainless Steel, Bristle, Fibre or Nylon
Special sizes and shapes to order.
Write (Dept. E) on your letterhead for catalog and price list.
DIXON & RIPPEL, INC. BOX 116, SAUGERTIES, N. Y.

USE READER SERVICE CARD; INDICATE A 461.

"INCREASE IN WAGES"

"The lessons have helped me considerably in my work; I have received an increase in wages since I started taking your course," writes plating foreman L. N. Riggs of Sabina, Ohio. Experience has shown that those men who take ELECTROPLATING KNOW HOW, the unique home study course, better themselves. Why not investigate? Write today! **Joseph B. Kushner, Electroplating School, 115 Broad St., Stroudsburg 12P, Pa.**

USE READER SERVICE CARD; INDICATE A 460.

Zialite
Reg. U. S. Pat. Off.

for NICKEL PLATING
The one bath especially designed for plating DIRECTLY on ZINC, LEAD, ALUMINUM, BRASS, COPPER and IRON.

for HARD CHROMIUM
USE Zialite ADDITION AGENTS
Harder CRACK FREE deposits. Increased throwing power. Less sensitivity to sulfate content. Exceptionally fine results plating anything calling for Decorative or Hard Chrome.

ZIALITE CORPORATION
92 Grove Street Worcester 5, Mass.

USE READER SERVICE CARD; INDICATE A 462.

made a suggestion that closer relations be established between midwestern branches by more visiting back and forth and by exchange of speakers.

Paul Chamberlain read a letter from **John P. Nichols** stating the urgency of getting replies from at least 80 per cent of the membership to the ABC questionnaire. Blanks were distributed to members who promised to send them in.

Paul G. Chamberlain
Secretary-Treasurer

MONTREAL

Convention Committees on Schedule

The meeting was called to order by President **P. M. Coady** with 28 members present.

The speaker of the evening **R. Strickland** was introduced by Mr. Coady in the absence of **J. Rennie.**

Mr. Strickland talked on "Chromate Finishes." The speaker was thanked on behalf of the branch by **J. L. Reisenburg Sr.**

A report on the Convention was given by **G. R. Davidson,** Convention Chairman, who reported that all committees were functioning well and were either on or ahead of schedule.

Pictures were taken of the branch in session by **N. Sheppard** who had phenomenal luck with his flashbulbs—all went off the first time, much to the chagrin of the other photography fans present.

J. L. Reisenburg Jr. moved that the date of this year's Dinner Dance be set for Sept. 28 and that the Queens Hotel be contacted about a reservation. Seconded by Mr. Davidson. Carried. Mr. Reisenburg offered to handle the reservation.

Three applications for membership were approved.

Talk on membership in the Society, its privileges and responsibilities was given by J. T. Reisenburg Sr.

Motion by G. R. Davidson seconded by C. Douglas that three copies of "Branch Officers Manual" be purchased by the branch.

A vote of thanks was given to G. Bagne and all parties concerned for the new gavel which was presented to the Branch.

NEW HAVEN

Tribute to Rosenthal; Questionnaire to Probe Attendance Problem

The regular meeting of the New Haven Branch was called to order Feb. 12, 1957, by President **Austin Jackson.** A moment of silence was observed in memory of **L. Rosenthal,** a charter member of the Branch, who passed away this past week.

The Educational Committee's report was read by **C. Kuster.** This report concerned technical papers for PLATING, the answer received from **Frank Eddy** and what New Haven's reply should be. It was suggested by **Al Fergerson** that Mr. Eddy or any other National officer be invited to attend a meeting of the New Haven Branch and discuss the problems with the members. **Ed Foley** expressed his opinion that AES members have to be educated to their obligation to submit papers to PLATING for publication. The final outcome was that the chairman of the Educational Committee write to National Headquarters and ask for one officer to talk to the members.

Mr. Foley reported on the course for platers at New Haven College. The first session of 15 weeks has been completed with 10 students finishing the course. The second session will start Feb. 18, and will run for 15 weeks. The sessions will be on "Electroplating Solutions."

On motion made and seconded, the membership committee is to send out questionnaires to all members asking why we do not have better attendance at meetings, what their interests are, etc.

New members are to be given the AES pin upon acceptance. A suggestion was made that the present members obtain lapel pins to wear. Wearing of pins might aid in getting new members.

A letter was read from the Bridgeport Branch announcing their "Old Timers Night."

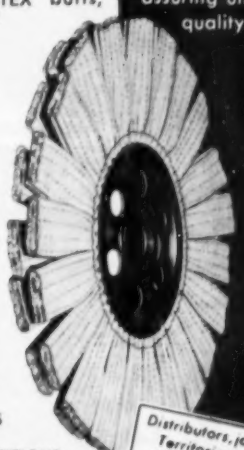
Austin Jackson made a report on the Regional Meeting. The Regional Convention is set for April 27, 1957 at the Statler Hotel, Hartford, Conn. **Dr. Walter Meyer** of Enthone, Inc., **Dr. Harry Walker** of Walker Division, Noma Hoff-

BISON CORPORATION

BUFFS

Precision manufactured on latest, modern equipment in the BISON Canton plant — assuring uniform quality.

Air-cooled VENTEX buffs, with permanent or removable metal centers are available for every job!



BUFFS • CLEANERS
COATED ABRASIVES
POLISHING WHEELS
ANODES • HEAT TREATING PRODUCTS
EQUIPMENT AND SUPPLIES • COMPOSITIONS

COMPLETE SERVICE FOR METAL FINISHING

Distributors, jobbers! Territories open! Write for details!

Bison Corporation

1935 ALLEN AVENUE S. E. • CANTON, OHIO

• INDUSTRIAL CHEMICALS •
• ACIDS • SOLVENTS • ALKALIES

WAREHOUSE STOCKS OR TRUCKLOADS DIRECT

PHONE GL 5-0284

USE READER SERVICE CARD; INDICATE A 463.

For ALL Your Metal Finishing Needs Depend on DAVIES

The Southwest's Leading Supplier of Industrial Plating and Polishing

- COATINGS
- CHEMICALS
- PLATING RACKS
- ABRASIVES
- EQUIPMENT
- ENGINEERING

Davies

Supply & Manufacturing Co.

4160 Meramec St. • MOhawk 4-9332 • ST. LOUIS 16

301 N. Market St. • RI 7-5423 • Dallas 1

813 W. 17th St. • BAltimore 1-2128 • Kansas City 8

USE READER SERVICE CARD; INDICATE A 464.

man Bearings, and **K. L. Bellinger** of Conversion Chemical Corp. will be the speakers. Dinner and dancing will follow the Education and Ladies' programs.

William Hottel, technical chairman, introduced the speaker of the evening, **E. L. Combs,** Chromium Chemical Division, Diamond Alkali Co., Cleveland, Ohio. Mr. Combs' subject "Chromium Plating Up to Date" was well presented and educational. A lively question and answer period followed.

The door prize was donated by Mr. Hottel, Diamond Alkali Co.

B. Gaffney
Secretary-Treasurer

NEW YORK
Prepare for Annual Session and Banquet

The Jan. 11 meeting was called to order by President **Derick Hartshorn Jr.**

Two membership applications were received.

It was reported that **Dave Clarin** is coming along nicely after a serious illness. **Grace Aaronson** has been hospitalized with an attack of appendicitis.

Dr. Ed Saubestre, reporting for the banquet committee expressed enthusiasm about the progress made to date. **Bob Solomon** promised many surprises for the ladies attending the afternoon tea. The speakers at the Educational Session will be: **Cleve Nixon,** head of Electrochemistry Div., Gen. Motors Research Labs.; **Leonard Chesworth,** chief chemist, United Carr Fastener Corp.; and **Dr. Henry Brown,** head of research, Udylite Corp.

Nominations of officers for the coming year will be held on Feb. 8.

Librarian **Joe Rembecki** presented the sound and color film "Corrosion in Action" which is distributed by the International Nickel Co. This three-part film, although previously shown at the N. Y. Branch, was viewed with approval. In the first part, "Nature of Corrosion" it was stated that corrosion is electrochemical in nature. The presence of oxygen, which is all important during corrosion was shown pictorially thanks to the unique technique of "time-lapse" photography. Part 2, "Origin & Characteristics of Corrosion Currents" explained the significance of the electromotive series. This chapter revealed that the more active metal is attacked more readily and that velocity has an effect on corrosion rate. Also it was illustrated graphically that there are currents in existence during corrosion. Part 3, "Passivity and Protective Films," in slow motion photography demonstrated unstable passivity. Stainless steel, passive in sulfuric acid, was shown being activated by hydrogen being released by contact with carbon steel. Finally, the narrator explained that more than 25,000 test samples are exposed to marine atmosphere at Kure Beach. Corrosion resistance is accurately gauged here under actual conditions.

Anthony P. Briganti
Recording Secretary

NEW YORK
Stockbaur Speaks on Preparing Aluminum Surfaces

The Jan. 25 meeting was called to order by First Vice President **George Herrmann.**

One new application for membership was received.

On behalf of the membership, a bouquet of flowers was sent to Miss Grace Aaronson, hospitalized because of an appendectomy.

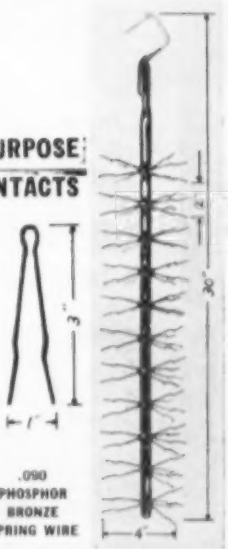
Librarian **Joe Rembecki** presented **Mr. Stockbaur** of the American Chemical Paint Co. whose topic was "The Preparation of Aluminum Surfaces for Painting." The speaker began with the statement that today, more aluminum is treated nonelectrolytically prior to painting rather than by electrolytic methods. From that point till he concluded, Stockbaur made many comparisons between the two methods stressing that the nonelectrolytic method was the more durable one. With the aid of a few slides the group saw some uses of the amorphous phosphate coatings as compared to the anodic-type coatings. Mr. Stockbaur, who has lectured quite a great deal on this subject, obviously im-

RACK OF THE MONTH!

#101
SINGLE SPLINE MULTI-PURPOSE PLATING RACK WITH 44 CONTACTS

Scientifically Designed for Speedier Racking, and completely coated with Plastisol 100% Solids Insulation.

—ORDER TODAY!—



.090 PHOSPHOR BRONZE SPRING WIRE

ONLY $5.20 Each F.O.B. SKOKIE, ILL.

AMERICAN RACK CO.
8139 NORTH LAWNDALE AVENUE, SKOKIE, ILL.

IMPROVE PLATING and ALKALINE DE-RUSTING

WITH PERIODIC-REVERSE UNITS OF FINEST QUALITY

UNIT PROCESS ASSEMBLIES, INC.
61 East Fourth Street • New York 3, N. Y.
UPA

USE READER SERVICE CARD; INDICATE A 466.

FOR SALE

Slightly Used BUFFS

Loose and Sewed
Air-Cooled

Any Quantity

MICHIGAN BUFF CO., INC.
3503 GAYLORD AVE. DETROIT (12), MICHIGAN

USE READER SERVICE CARD; INDICATE A 465.
USE READER SERVICE CARD; INDICATE A 467.

pressed those present, for the discussion period that followed was active, interesting and informative.

Anthony P. Briganti
Recording Secretary

NEWARK

Papers Presented on Rhodium Plating and Anodizing Aluminum

The February meeting was held on the 15th with President **Struyk** presiding over the 90 members and guests present.

Three men were elected to membership and eight applications were received.

The nominating committee, **Robert Ehrhardt,** chairman, **T. Austin** and **John Kosmos,** presented a slate of officers for the election to be held in March. **William Grigat,** chairman of the membership committee, noted that each member of the Branch, as a member of the committee, received an application with the February Sparks. He also pointed out the fact that this year Newark is leading the first division in membership increase and that each member should be interested in keeping the Branch there.

D. Foulke, reporting in the absence of **George Wagner,** stated the Christmas Party had been a financial as well as a social success with a profit of about the same as last year in spite of holding the ticket cost in face of higher meal costs.

He also reported Technical Societies Council of New Jersey symposium "Controlled Quality—A Key to Profits" and an evening program on "Some Problems in Processing Water" was scheduled for the afternoon and evening of March 28, 1957.

Dr. Dodd Carr then introduced **Dr. Karl Schumpelt** of Sel-Rex Corporation who discussed "Rhodium Plating—Past and Present," reviewing past difficulties and pointed out how a trace of lead accounted for improved deposits at one time. He predicted for the future more use of heavy deposits.

Richard Hafer, chief finishing engineer, of Reynolds Metals Company, then presented the principal talk of the evening "New Developments in Anodizing Aluminum." He pointed out that developments in the past five years have been in application rather than in the discovery of new principles. Mr. Hafer discussed reasons for porous and nonporous anodic coatings and the properties of the two types of films. A number of slides were shown of the various applications for which aluminum is now used, including architectural, automotive, and electrical (dielectric) uses.

D. Gardner Foulke
Secretary

PHILADELPHIA

May Form Organic Finishing Section

The regular meeting of the Philadelphia Branch was held on Feb. 25 at the Engineers' Club; 41 were at dinner, 55 at the meeting. Among the guests introduced at the start of the meeting was **Robert G. Parker,** secretary-treasurer of the Bridgeport Branch. Four active members were admitted and five applications were received.

Eugene Zurbach, Edwin F. Ottens and **James T. Carlin** were appointed as the committee to investigate the possibility of the Branch establishing an Organic Finishing Section. The secretary read the following: The Feb. 1 letter giving the current sustaining membership count and status; the titles and locations of present Research Projects as given in the Jan. 25 report; the Feb. 14 letter on the ABC form return; an employment opportunity; and spoke of the need of PLATING for papers, announcing the new publishing specifications for authors.

Branch President Truesdell spoke of the Feb. 21 letter from National Headquarters regarding the voiding of per capita tax refunds. After considerable discussion from the floor, the following was adopted unanimously: Resolved, that the Philadelphia Branch is opposed to any change in per capita tax refund schedule.

The speaker was **Dr. Leslie E. Laney,** who spoke on his well-known method of simplified waste treatment for the use of the electroplating industry.

I. Wm. Marcovitch
Secretary

BUFFS *By* **GUARANTEED** *For Finer Finishing*

Complete Line of Guaranteed, Quality

BUFFS & POLISHING WHEELS

Straight and 45° "Spoke Buffs"
Patented, Ventilated and Biased

Serving the Finishing Industry for
MORE THAN 50 YEARS

GUARANTEED BUFF CO., Inc.
20 Vandam Street, New York 13, New York

USE READER SERVICE CARD; INDICATE A 468.

Anode Bags · Baffle Bags
Basket Saver Bags

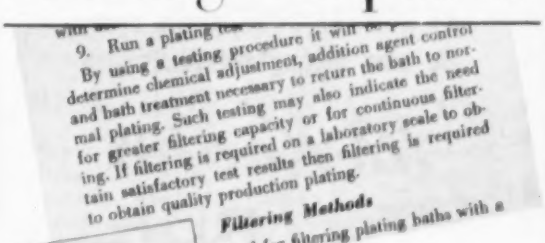
OF EXCEPTIONAL PURITY AND UTILITY

- ALLIED bags are standard throughout the country, yet are lowest in price.
- Material especially known for strength treated for removal of starches, plastisizers, and leaf.
- Anode bags of cotton nylon, vinyon, orlan, dynel and polyethylene.

ALLIED INDUSTRIES CO. 18400 MT. ELLIOTT AVE. DETROIT 34, MICHIGAN

We make more anode bags than all other makers combined

Testing For Causes of Rough Deposits?



9. Run a plating test ... will be ...

By using a testing procedure it will be possible to determine chemical adjustment, addition agent control and bath treatment necessary to return the bath to normal plating. Such testing may also indicate the need for greater filtering capacity or for continuous filtering. If filtering is required on a laboratory scale to obtain satisfactory test results then filtering is required to obtain quality production plating.

Filtering Methods

... method for filtering plating baths with a

FREE! Your guide to better plating

This technical article — "The Use of Filters in Electroplating" — written especially for you by Mr. J. B. Mohler, Finishing Consultant is available to you for the asking. Write for your free complimentary copy today.

Write

ALSOP ENGINEERING CORPORATION
1204 Fine St., Milldale, Connecticut

USE READER SERVICE CARD; INDICATE A 470.

PITTSBURGH

New Officers Nominated; Plan Ladies Auxiliary

The regular monthly meeting of the Pittsburgh Branch was held Feb. 6 at the Gateway Plaza.

Dinner was attended by approximately 65 members and guests. Included were 23 wives of members who hope to start an Auxiliary in Pittsburgh.

After dinner President **Myron Ceresa** welcomed the ladies and introduced **R. Burford,** chairman of the committee to get the ladies out. Entertainment in the form of a bingo game was provided for the women while the men held their regular business meeting. Prizes were donated by the various suppliers of the area.

One new member was elected.

A report on the Ladies Night Banquet scheduled for Saturday, April 27 was made by President Ceresa. This gala affair is to be held at the Gateway Plaza and promises to be a worthwhile evening of entertainment for our membership and friends. R. Burford and **F. Mountain** are handling the arrangements this year.

There were ten guests present at the meeting. Each was asked to introduce himself and give his company affiliation.

A letter from **J. Coros,** who was absent due to a recent accident, was read concerning the January Interim meeting. The meeting was attended by 50 to 55 delegates and National Officers of the Supreme Society making it one of the most successful since this type of meeting was instituted by Past President **Cleve Nixon.**

The slate prepared by the nominating committee under the chairmanship of **E. J. Smith** was read by Secretary **F. Stevens.** It is as follows: President, **I. H. Schram Jr.;** First Vice President, **J. R. Crain;** Second Vice President, **W. F. Pizoli;** Secretary, **W. F. Stevens;** Treasurer, **R. E. Woehrle;** Librarian, **W. J. Musmanno;** Delegates, **E. J. Smith,** Myron Ceresa and **R. A. Woofter;** Alternate Delegates, **R. H. Schindler; R. E. Varner** and **R. J. Goldbach;** Board of Managers, R. E. Varner, R. H. Schindler and Myron Ceresa. Nominations were invited from the floor by President M. Ceresa. There were none, but President Ceresa reminded the group that nominations will be open again.

Librarian R. E. Woehrle introduced **Dr. S. Spring,** laboratory director of the Kelite Corp. The subject of Dr. Spring's paper was "Preparation of Metal Surfaces for Painting as by Phosphatizing."

During the short break which followed Dr. Spring's paper, the drawing for the door prize was held. The prize, a Lazy Susan donated by R. Goldbach of Harshaw Chemicals was won by **E. Keller.** The ladies also had a grand prize, an electric fry pan, which was won by **Mrs. J. Mechtly.**

Fred Stevens

PROVIDENCE-ATTLEBORO

Forum on Plating Substitutes for Motion Picture

The Providence-Attleboro Branch met Monday evening, Feb. 18, 1957, at the Providence Engineering Society Building at 195 Angell St., Providence.

President **Sibley Kershaw** called the meeting to order. **Arthur Wood** was welcomed back after recovering from his injuries. **James Potter,** one of our Honorary members, was presented to the group.

President Kershaw read a request from the National Headquarters for ABC registration of the members of the Branch. He passed our registration forms to those who requested them.

A breakdown in the projection equipment prevented the showing of a movie supplied by the Sel Rex Co. In its place, a forum under the direction of **Pierre Lonsbury** was held. Many questions were discussed concerning plating and several interesting comments evolved.

F. L. Sherman

ROCKFORD

Triple Feature Meeting

With 35 present for dinner and 48 in attendance for the business session which followed, the Rockford Branch held its regular monthly meeting at the Faust hotel Monday, Feb. 11, 1957.

ZINC PLATERS:

FOR QUALITY PERFORMANCE AT LOWEST COST, purify cyanide zinc plating solutions with

McKeon's Zinc-Brite

TRADE MARK REG. U.S. PAT. OFF.

Regular use keeps zinc solutions constantly clear. Eliminates need for ANY OTHER purifying treatment. Brightens work.

Write-Phone-Wire Collect

Sulphur Products Co. Inc.

621 West Pittsburgh St.
Greensburg, Pa.

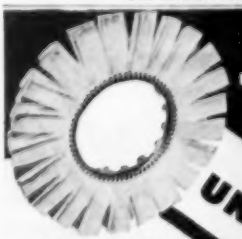
PROMAT

PROMAT has the finest in metal preparation, alloy plating, cadmium plating, chromate finishes, copper plating, zinc plating and miscellaneous purifiers and anti-foam agents.

PROMAT will gladly prepare a sample for evaluation, furnish you with technical bulletins and information or assist you in any way possible.

PROMAT A DIVISION OF POOR & CO.
851 S. MARKET STREET · WAUKEGAN, ILLINOIS
"PROMAT MEANS PROTECTIVE MATERIALS"

USE READER SERVICE CARD; INDICATE A 472.



FOR EXTRA FLEXIBILITY
CUTS AND COLORS IN ONE OPERATION
on CONTOURED SURFACES

CENTERLESS UNIT SISAL BUFF

for more keys to GREATER BUFFING OUTPUT
See pages 376, 418, 434

AMERICAN BUFF COMPANY
2414 South LaSalle Street Chicago 16, Illinois

Vern Wissen reported on the Annual Educational Session and Banquet to be held Mar. 30 and announced everything was in readiness for the coming event.

Al Overbey, who was appointed chairman of the Nominating Committee, presented a new slate of officers for the local branch to vote on at the March meeting.

An interesting film, "Production Maintenance," was shown.

Bob Twyning introduced **J. D. Thomas** of the research staff of the General Motors Corp. who discussed the "Behavior of Plated Parts on Cars," and the study of acetic acid salt spray testing. Mr. Thomas certainly presented a fine talk which was well received, which the question and answer period proved.

As an added feature **Nick Servatins,** owner of the Modern Plating Co. of Freeport gave an interesting talk on his recent travels to Europe.

Nick, who is a good friend of all members of our branch, drew a tremendous round of applause.

E. J. Budden
Secretary-Treasurer

ST. JOSEPH VALLEY
Andrus Delivers Paper on Anodizing

A record number of 82 members and guests attended the February meeting of the St. Joseph Valley Branch. The meeting was opened by President **Gene Roth** who appointed **Drs. Wilhelm** and **Wiesner** and **Ralph Brouwer** as the nominating committee. He called on 3rd Vice President **Ralph D. Wysong** to report on the Interim meeting held in Pittsburgh.

Dr. Harold Wiesner then spoke on the proposed course in electroplating to be sponsored by the branch. The first educational meeting will be held Feb. 13 with Dr. Wiesner instructing.

President Roth welcomed a new member transferred from the Grand Rapids Branch. One man was elected to membership and one application was read and approved.

Dr. Harold Wiesner introduced **Joe Andrus,** the guest speaker. Mr. Andrus received his education at the University of Detroit and did graduate work at Illinois Institute of Technology. His topic was "Decorative Anodizing." In part, Mr. Andrus told the Branch:

"Anodizing, the process by which an aluminum surface is converted to the very hard and abrasive resistant Al_2O_3, differs from natural Al_2O_3 in that it is a transparent film. The transparency of the film is dependent on the degree of purity of the base aluminum. The thicknesses obtained are in the order of 0.0001 in.

"Characteristic vertical capillaries perpendicular to the aluminum base are visible under the electron microscope. The capillaries afford solution contact with the metal through the dielectric film of Al_2O_3. They also serve to absorb dyes in subsequent coloring operations.

"The prime consideration in decorative anodizing is a high luster which is dependent on (1) the nature of the base metal, (2) pre-treatment, and (3) thickness of the applied film.

"Mercuric chloride solutions have been used to dissolve away the aluminum base metal to leave the Al_2O_3 film intact. This clearly shows that any occluded impurities will materially darken the film. Purity of base metal is not the entire criterion. Though ultra-high purity aluminum yields the most transparent and lustrous film, it is too soft. Therefore, Al-Mg alloys are used for their strength. Magnesium doesn't enter into the film but apparently dissolves out.

"Castings of intricate shapes, because of high silicon content, introduce difficulties in coloring of the films. Silicon darkens and is not suitable for bright anodizing. The 13 per cent silicon-aluminum eutectic forms a very dark film. A particular alloy clad with 5 per cent silicon bearing material is anodized at 250 amp min/ft² to yield a gray finish and take advantage of the graying tendency of the silicon. Some of the effects caused by silicon can be compensated for by proper heat treatment. 75S ultra-high strength, precipitation hardening alloy showed a pronounced difference before and after annealing.

"The applied current is allowed access to the base metal by the capillaries. The

SUPER-MARKET FOR ANODES

BUY DIRECT FROM METAL CONVERTER!

Nickel anodes up to 93 inches in length . . . of the highest purity. Density of anodes is at a maximum. Longer life in plating bath.

NICKEL RECASTING PRICE SCHEDULE

ANY QUANTITY only 99+ purity accepted

15c PER POUND FOB UNIVERTICAL

Laboratory Controlled

Write or wire for best price and delivery on the following anodes:

Copper-Electro Deposited	Phos. Copper
Copper-Cast Round 3" Dia.	White Brass
Copper-Cast Round 2½" Dia.	Zinc
Copper-Cast Beehives	Tin
Copper-Cast Balls	Lead
Copper-Forged Balls	Carbon
Copper-Rolled Oval 1½" x 3"	

UNIVERTICAL Since 1939
FOUNDRY AND MACHINE COMPANY
14841 Meyers Rd. BRoadway 3-2000 Detroit 27, Michigan

DIESEL
Catering to metal finishers needs!

ANODES *(all forms and sizes)*
Nickel, Zinc, Tin, Brass, Cadmium, Copper, Silver, Lead-Antimony, For Chrome.

PLATING CHEMICALS
Nickel Sulphate, Nickel Chloride Imported, Nickel Carbonate, Nickel Acetate, Potassium Cyanide, Copper Cyanide, Zinc Cyanide, Sodium Cyanide Eggs, Cobalt Sulphate, Cadmium Oxide, Trichlorethylene—Stabilized, Perchlorethylene, Caustic Soda, Caustic Potash, All Acids, Zinc Salts No. 1, reasonable.

NEW AND USED EQUIPMENT
Prompt Deliveries—Complete Stock at all times
WE PURCHASE SCRAP METALS

DIESEL CHEMICAL COMPANY
578P Carroll St., Brooklyn 15, N. Y.
MAin 2-0703-4
"A trial will convince you"

MEMBER Allied Finishing Suppliers Inc.

capillaries being formed by solvent action of the acid electrolyte. Electron microscope studies show that a lower applied voltage yields a smaller pore size. A dense barrier layer of 14 angstrom units is formed per volt of applied current. The softer and more porous portion exists nearest the electrolyte. The solvent action of the electrolyte increases as temperature increases.

"Alloying constituents present in the base metal contribute color to the anodic film. Chromium bearing 52S alloy yields a golden anodic film because of hexavalent chromium compounds. The alloy is extremely stable to outdoor exposure but requires 500 amp min/ft² of applied current.

"Surface preparation aids in film brightness. Buffing of aluminum imbeds buffing compounds and also work-hardens the surface. To properly prepare the buffed surface requires anodizing, stripping of the film in phosphoric acid and reanodizing. Because of the increased operational costs of this method, it is more economical to bright-dip or electropolish the base metal than to buff. Bright dipping is favored over electropolishing because of no current requirements or anodes.

"Composition of three common bright dips are as follows:

Phosphoric acid	80.5%
Nitric acid	3.5%
Water	16.0%

Sulfuric acid	25%/vol.
Phosphoric acid	50%/vol.
Acetic acid	6%
Nitric acid	6.5%
Water	balance

Nitric acid	86%
Sodium nitrate	9%
Sodium sulfate	4%
Cadmium sulfate	1%

"Higher acid concentrations require greater agitation because of temperature increase. Because the capillary size changes greatly with the temperature (e.g., 72° gives optimum gold color while 68° yields no color) agitation is an important factor in coloring. The anodic film exerts much insulating effect for the applied current to overcome. Normal currents range from 10–14 asf but may go as low as 2 asf and as high as 24 asf. Better throwing power and uniformity is obtained at the lowest current density."

Mr. Andrus listed the important rules to be followed for consistent results as:

1. Temperature control of anodizing bath
2. Acid and aluminum content of the bath
3. Constant current density
4. Good agitation
5. Excellent rinsing
6. Constant dye concentration
7. Choose dyes that have same absorption rate if two are necessary
8. Constant dye bath temperature
9. Operator that isn't color blind.

After answering numerous questions, Mr. Andrus was given a standing ovation for an exceedingly interesting and well presented paper.

Henry A. Meers
Secretary

ST. LOUIS

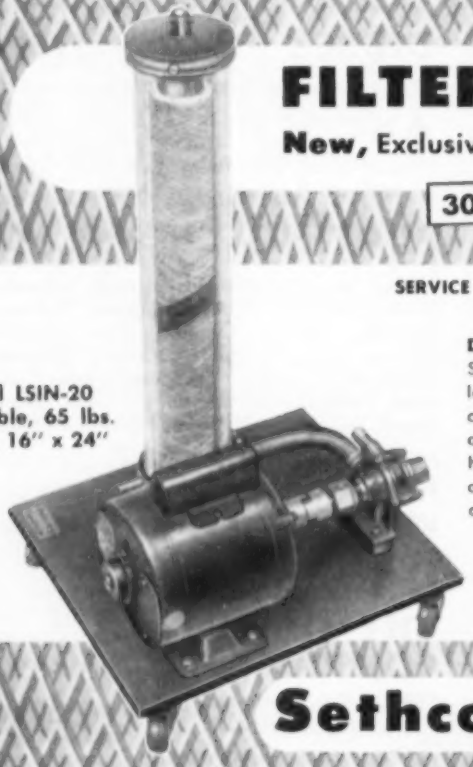
Class Awarded Certificates

The regular monthly meeting of the St. Louis Branch was held at the York Hotel, Feb. 13 with 33 present for dinner. The business meeting was called to order with 42 members and guests present. There was no business meeting in January due to the joint meeting with the American Society of Corrosion Engineers. At the joint meeting **Paul Schwartzel** represented the AES on a panel discussing methods of protecting metals from corrosion.

Louis Berra reported the spring banquet will be held in May.

The Educational Committee reported our class at O'Fallon Technical School finished with the highest percentage of pupils. **Otto Klein** who instructed the course last semester and is carrying on this semester presented certificates for satisfactory completion of the first semester to 15 students.

Librarian **Ed Sertl** introduced **Dr. H. R. Hanley,** a member of the St. Louis Branch since 1940, and semi-retired professor at the University of Missouri School



FILTER with a Sethco

New, Exclusive Self-Priming **FILTER PUMP**

300 GALS. PER HOUR

SERVICE — Filters any acid or alkaline plating solution from ph 0 to ph 14. Removes particles down to 1 micron.

DESIGN: Filter Assembly as illustrated in H.T. Lucite (also available in Stainless Steel 316, Haveg, Epoxy Resin, Rigid Vinyl, Saran, Polyethylene, Teflon). Filter Tubes of cotton, dynel, porous stone or porous carbon. PUMP: Self-priming, Stainless Steel 316 (also available in an all plastic construction). Available as Centrifugal in Stainless Steel or Hasteloy. Motor is ¼ H.P., totally enclosed Ball Bearing. HOSE: acid and alkaline resistant. Base Platform: linen-impregnated phenolic laminate on rubber tire, ball bearing casters.

Model LSIN-20
portable, 65 lbs.
14" x 16" x 24"

25 Stock Models to fit your needs. 50 to 2,400 gal./hr. cap. Others to your specifications.

JUST OFF THE PRESS — write for illustrated fact-folder on the complete line of filters by Sethco.

Sethco Mfg. Co. 74 WILLOUGHBY STREET BKLYN. 1, N. Y. · ULster 5-8940

of Mines and Metallurgy. He related the problems encountered in establishing a department of mines and metallurgy for a Chinese University on Formosa. Dr. Hanley spent three years traveling completely around the world. He showed many colored slides of the interesting places he visited and related many unusual customs of the Chinese.

Ward Kelly
Secretary-Treasurer

SPRINGFIELD

Tour of Westinghouse Plant

The Springfield Branch started the Feb. 25 meeting with an afternoon visitation at the East Springfield plant of the Westinghouse Electric Corp., from 4:30 to 6 p.m., through the efforts of First Vice President **Charles F. Griffin Jr.**, an engineer at Westinghouse. The guests were greeted by Mr. Griffin, **Elery C. Gibson** and **Colin Hastie**, all members of the Springfield Branch and all Westinghouse hosts. The "Queen Mary," as the huge new automatic is called was in full scale operation for this visitation, and all questions were answered.

After the tour, the members met at Blake's Restaurant for a social period and dinner. After dinner, President **Roger Heroux** opened the business meeting. Delegates to the National Convention in Montreal were chosen: **Walter J. Dyber**, Roger R. Heroux, and **Henry L. Heissfeld.** Alternates are as follows: **William J. Grover Jr., Robert J. Girard** and **Edward R. Dupuis.**

Mr. Girard gave a final report and accounting on the educational program and course. The membership gave Mr. Girard, the chairman, and his committee of **Ralph Mongeau** and William J. Grover Jr. a rising vote of thanks for a job well done.

President Heroux asked for volunteers for registration duty at the Regional Meeting, to be held in Hartford, at the Hotel Statler, on Saturday, April 27. The three volunteers are: **John E. Costigan, Wayne Sanders** and Edward Dupuis.

The next order of business was the appointment of a nominating committee to select a slate of officers for the coming season. Mr. Dupuis was appointed chairman, and **Earnest Couture** and Robert J. Girard will serve with him.

The secretary read the Audit Bureau plea for return of information forms to National Headquarters.

Librarian **Anthony S. Horta** introduced the speaker for the Technical Session, **George Brumbaugh,** Technical Standards Department of the American Chemical Paint Co., Ambler, Pa. His subject was "Corrosion Resistance of Aluminum."

The attendance at this meeting was the largest of the present season, with over 40 members and guests present.

Henry L. Heissfeld
Secretary

WATERBURY

The Feb. 7 business meeting was held at the home of **Francis T. Eddy** in Watertown, Conn. **Spencer Henn** gave a brief description of the progress of the regional committee meeting held in Hartford. **Herbert Moran** is chairman of the entertainment committee for the Regional Convention which is to be held in Hartford on April 27. Secretary **Al Griffith** announced he had the tickets for the Convention ready for distribution. Spencer Henn presented four new applications for membership.

The Sustaining Members' Night held as our January meeting was a success and should be an annual affair.

Mr. Eddy gave a report on the highlights of the Interim Meeting held on Jan. 12 in Pittsburgh. **Joseph Petrocelli,** chairman of the nominating committee, presented the following slate of officers for the year 1957–1958:

President, S. Henn; first vice president, **E. Garland;** second vice president, **F. Tirendi;** secretary-treasurer, **A. Griffith;** librarian, **I. Cross;** assistant librarian, **L. Porretti;** publicity, **N. Topazio;** delegates, **E. Candee,** F. Eddy, F. Tirendi; alternates, **B. Coleman,** L. Porretti; board of managers, **P. Sloane, T. Voyda,** J. Petrocelli.

The Technical Meeting was held Feb. 14, at the Roger Smith-Elton Hotel. The report of the Business Meeting of Feb. 7 was read by Vice President Spencer Henn.

LEA GRIPMASTER®

Industry's Abrasive { **BONDING CEMENT for Wheels and Belts**

SIZES AS WELL AS BONDS

Gripmaster cuts out one preparation material and one preparation step. No special sizing is necessary. This superior bonding cement has a double use. But seein' is believin'. Test Gripmaster in your own plant under your own working conditions. Send us the enclosed coupon or use your company stationery and we'll send you a test size sample *without charge or obligation.*

LEA-MICHIGAN, INC.
14066 Stansbury Ave., Detroit 27, Michigan
(A member of the well-known Lea Group of Finishing Specialists)

Lea-Michigan, Inc.
14066 Stansbury Ave.
Detroit 27, Mich.

☐ Please send us your free sample of GRIPMASTER.
☐ Please send us literature giving full details.

Name _____ Title _____
Company _____
Address _____ P-4-57

RUSH
IS NO PROBLEM

ORDER
SPRAY NOZZLES
FROM SPRAYING SYSTEMS

• An important part of our service to customers is our "immediate" delivery department. Whatever brand of nozzle you may be using, you can replace with Spraying Systems . . . and obtain equal or better spray characteristics and improve your operation. We maintain a complete stock of all standard types and capacities . . . average inventory over 12,000 nozzle TYPES ...for shipment of rush orders on same day received.

WRITE FOR CATALOG 24 . . . forty-eight pages of complete data on thousands of nozzle types and capacities.

SPRAYING SYSTEMS CO.
3227 RANDOLPH STREET • BELLWOOD, ILLINOIS

ADVANCED SPRAY NOZZLE DESIGN FOR NEW DIMENSIONS IN CONTROL AND PERFORMANCE

The meeting was turned over to **Edward Garland**, technical chairman. The speaker for the evening was **A. Knotowicz**, research engineer at The Patent Button Co., Waterbury. His subject was "Basic Polaragraphy for Electroplating." He demonstrated the recording type polaragraph and also the micro-ammeter type polaragraph.

Nicholas Topazio
Publicity Director

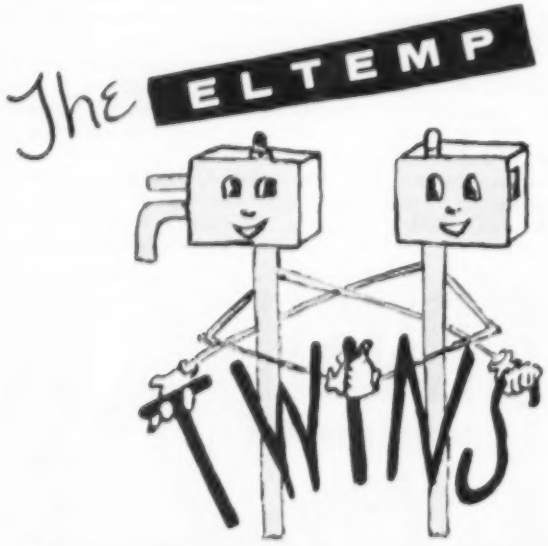
WESTERN ONTARIO
To Work Toward Top Level Representation

The Western Ontario Branch held its regular meeting at the William Pitt Hotel, in Chatham, Ontario, on Feb. 15.

A committee consisting of **N. J. Southern, Paul Croly, Les Crooks** was appointed to nominate the slate of officers for the 1957–58 season.

Kergin Wells, with W. W. Wells Ltd., spoke on "Unconventional Methods of Belt Polishing." It included a method of making your own type of abrasive belt or recoating your worn out abrasive belts with compound. Mr. Wells suggested that Canada has grown in the plating industry to the point where we should have direct representation on the AES executive board, and participate in setting of policy and exchange of ideas at the executive level. It was wholeheartedly concurred by the membership that we work to this end.

Earl L. Patterson
Vice President



ELTEMP LEVEL CONTROL
For Chemical Solutions

Acid Resistant
+
Simple Design
+
NO Moving or Electrical Parts
+
Maintains Solution Level ±3/8 in.

= Positive and Safe Way to add water to maintain desired level of any chemical solution having a specific gravity of 1.140 or heavier. Tanks must be at least 3 ft. deep.

Several Models—$28.50 up

For complete information write Dept. EL

ELTEMP THERMOSTAT
For Chemical Solutions

Acid Resistant
+
Dependability
+
Accurate Operation
+
Simplicity

= Years of Satisfactory Service. The Eltemp Thermostat automatically regulates the operation of heating or cooling sources to a temperature tolerance of ±1° F. in solutions having a constant level.

Several Models—$48.50 up

For complete information write Dept. ET

ELKHART CONTROLS CO.

Route No. 2 Elkhart, Indiana

CLASSIFIED ADVERTISEMENTS

Only "Help Wanted" and "Situations Wanted" will be accepted. Rates: $.20 per word, minimum $5.00. AES branch members and members-at-large only, in good standing, are entitled to a total of three *free* advertisements in any twelve month period as of first insertion. Last day for inserting advertisements is the 10th of month preceding date of publication. When answering advertisements please address as follows: Box number, PLATING, 445 Broad Street, Newark 2, N. J.

CONSULTANT—11 Years of Experience in Metal Finishing, is seeking additional clients. Recent successes on a part time basis stimulated desire to plunge in full time. Reference furnished. Your inquiry will receive prompt attention. Reply to Box AP 1, PLATING, 445 Broad St., Newark 2, N. J.

ELECTROFORMING—Exceptional opportunity for experienced man to take charge of department producing spray masks, molds for plastics and specialized heavy plating for industry. Established growing company in Mid West. Give experience, education and remuneration desired in first letter. All replies strictly confidential. Box AP 2, PLATING, 445 Broad St., Newark 2, N. J.

CHEMIST—15 years' experience in chemical, metallurgical, engineering, administrative aspects of metal finishing. Original work in conversion coatings, precision alloy plating, continuous anodizing and dyeing of aluminum wire and foil. Patents. Seeks responsible position in or near Metropolitan New York. Reply to Box AP 3, PLATING, 445 Broad St., Newark 2, N. J.

SUPERVISOR with 33 years' plating experience seeks position, preferably in Wisconsin area. Experience includes 28 years of plating in job shop, 3 years of plating and paint of air craft, 2 years in automotive plating bonderizing and painting. Will give references. Box AP 4, PLATING, 445 Broad St., Newark 2, N. J.

SITUATION WANTED—Supervisor with over 35 years' plating experience seeks position, preferably in Canada. Experience includes 30 years as Supervisor of Polishing, Buffing & Plating Dept. Looking for a position as a traveling salesman for Plating Supplies or consultant in Plating and Polishing. Reply to Box AP 5, PLATING, 445 Broad St., Newark 2, N. J.

SITUATION WANTED—Sales Engineer, Chemical Engineer with 12 years' supervisory experience in production electroplating and metal finishing operations including process development, equipment lay-out and related operations and control seeks position as sales or service engineer in the midwest or west coast area. Reply to Box AP 6, PLATING, 445 Broad St., Newark 2, N. J.

CHEMIST—Plating and Metal Finishing—German Technical University graduate analytical chemist wants to change position. 49 years old, widowed, single. Now chief chemist with one of the leading manufacturers in mideast of plating and finishing chemical Analysis, control; research, development. Reply to Box AP 7, PLATING, 445 Broad St., Newark 2, N. J.

Tamms

NEW! DUSTEX MICRO-SILICA

Soft amorphous type with these special features

OIL ABSORPTION (G & C)	36.4 to 40.3 LBS.
pH VALUE	5.0 to 5.2
MOISTURE	0.5%

A NEW PROCESS SILICA

PARTICLE SIZE RANGE 1 TO 15 MICRONS

98% MINUS 10 MICRONS

New improved equipment assures highest quality and production control

WRITE TODAY FOR SAMPLES, PRICES AND SPECIFICATIONS

DEPT. RM-22

TAMMS INDUSTRIES, INC.

228 N. LA SALLE ST., CHICAGO 1, ILL.

USE READER SERVICE CARD; INDICATE A 480.

For Metal Finishers!

Pressure Moulded NEOPRENE **"CAPLUGS"**

7 STANDARD SIZES

	A	B	C	D	E	F	G
TO PLUG HOLE SIZE	1/8-3/16	3/16-1/4	1/4-5/16	5/16-1/2	1/2-5/8	9/16-11/16	5/8-3/4
TO CAP STUD SIZE	3/32-5/32	5/32-3/16	3/16-1/4	1/4-5/16	5/16-3/8	3/8-7/16	9/16-1/2

MASKING PROBLEMS OUR SPECIALTY!

WRITE FOR FREE SAMPLE KIT

DUGGAN Masking Devices

2030 WEST FORT STREET
DETROIT 16, MICHIGAN

USE READER SERVICE CARD; INDICATE A 482.

ARco RUBBER "DRUMSERTS"

FOR MIXING—STORING AND HANDLING *CORROSIVES*

Inserted easily . . . lapped over quickly!

ONLY $19.75 neoprene or rubber

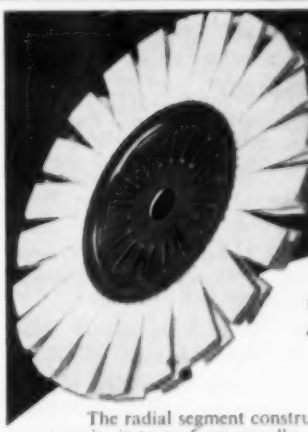
- "Drumserts" are pre-formed, independent linings made of ARco-compounded neoprene or rubber . . . can be inserted in any standard 55 gallon drum in just a few seconds. "Drumserts" are rugged, clean, remain stable, and permit complete handling of drum. Prevents product contamination.

Rubber "Snap-on" lids for "Drumserts" $9.90

Write dept. "P" for details

AUTOMOTIVE RUBBER CO., INC.

12550 BEECH ROAD, DETROIT 39, MICHIGAN



"A Flexible and Resilient Buff for Flat or Irregular Surfaces"

FORMAX

ZIP-TIP BUFFS

The radial segment construction of the Zip-Tip Buff permits it to perform equally well on flat or contoured surfaces. The cross-cutting movement of the spoke-shaped segments prevent work streaking while it breaks up straight-line patterns on the surface.

- Zip-Tips are available in a wide variety of all cloth constructions—also combinations of cloth and sisal.
- Zip-Tips are made of heavy-duty, bias-cut materials mounted on ventilated steel centers.
- Zip-Tips are extra thick and provide wider buff faces with greater compound retention capacity.
- Zip-Tips are perfectly balanced—require no raking.

Write for Descriptive Literature

FORMAX MFG. CORP.

DETROIT 7, MICHIGAN

"THE FOUR McALEERS"

USE READER SERVICE CARD; INDICATE A 483.

FUTURE MEETINGS

AES

April 26—**Executive Board,** National Headquarters, Newark, N. J.

April 27-28—**Executive Board,** Hotel Statler, New York, N. Y.

April 27—**18th Annual New England Regional Meeting,** Statler Hotel, Hartford, Conn.

April 27—**3rd Empire State Regional Meeting,** Grand Ballroom, Onondaga Hotel, Syracuse, New York.

April 27—**Milwaukee Branch,** Symposium, IMPORTANT ENGINEERING CONSIDERATION IN THE PLATING ROOM, Hotel Schroeder, Milwaukee, Wis.

April 27—**Pittsburgh Branch, Ladies Night Dinner and Dance,** Gateway Plaza, Pittsburgh, Pa.

May 4—**Boston Branch, 21st Annual Banquet and Technical Session,** Hotel Statler, Boston, Mass.

May 4—**Toronto Branch,** Annual Regional Meeting, Sheraton-Brock Hotel, Niagara Falls, Ontario, Canada

June 16-20—**44th AES Annual Convention,** Sheraton-Mount Royal Hotel, Montreal, Canada

November 2—**Philadelphia Branch,** Annual Educational Session and Banquet, Penn Sheraton Hotel, Philadelphia, Pa.

May 19-22, 1958—**45th AES Annual Convention,** Sheraton-Gibson Hotel, Cincinnati, Ohio

June 14-18, 1959—**46th AES Annual Convention,** Detroit, Mich.

INTERSOCIETY

May 11—**Masters' Electroplating Association of New York,** 39th Annual Banquet, Plaza Hotel, New York, N. Y.

May 12-16—**Electrochemical Society,** Statler Hotel, Washington, D. C.

May 13-15—**12th Purdue Industrial Waste Conference,** Purdue Memorial Union Building, Purdue University, Lafayette, Ind.

June 11-13—**3rd Western Plant Maintenance Show,** Civic Auditorium, San Francisco, Calif.

June 14—**Society of Plastics Engineers,** Regional Technical Conference, PLASTICS FOR ELECTRONICS, Lowell Institute of Technology, Lowell, Mass.

June 16-17—**National Association of Metal Finishers,** Annual Convention, Sheraton-Mount Royal Hotel, Montreal, Canada

June 16-21—**American Society for Testing Materials,** Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

August 7-9—**6th Annual Conference on Industrial Applications of X-Ray Analysis,** Denver Research Institute, Metallurgy Division, University of Denver, Denver, Colorado.

November 4-8—**39th National Metal Exposition and Congress,** International Amphitheatre, Chicago, Ill.

AES DIRECTORY

OFFICERS

President.....DR. SAMUEL HEIMAN
Philadelphia Rust Proof Company, Inc.
3227 Frankford Avenue, Philadelphia 34, Pa.

First Vice President.....FRANCIS T. EDDY
Technicraft Laboratories, Inc.
Thomaston-Waterbury Road, Thomaston, Conn.

Second Vice President.....HERBERTH E. HEAD
Automotive Body Division
Chrysler Corporation
Detroit 31, Mich.

Third Vice President.....RALPH D. WYSONG
Studebaker-Packard Corp.
635 S. Main St., South Bend 27, Ind.

Past President.....CLYDE KELLY
American Plating Company
808 Keo Way, Des Moines, Iowa

Executive Secretary.....JOHN P. NICHOLS
445 Broad St., Newark 2, N. J.

RESEARCH COMMITTEE

Chairman.....ARTHUR H. DU ROSE
Harshaw Chemical Company
1945 East 97th St.
Cleveland 6, Ohio

Vice Chairman, Research ROBERT A. EHRHARDT
Bell Telephone Laboratories, Inc.
Murray Hill, N. J.

Vice Chairman, Finance.ARTHUR P. WRISBERG
Davies Supply and Manufacturing Company
32 Villa-Wood Lane
Webster Groves 19, Mo.

Secretary.....JOHN P. NICHOLS
445 Broad Street, Newark 2, N. J.

BRANCH DIRECTORY CHANGES

NEW YORK—Secretary: Address Change. Milton Nadel, 9-05 162nd St., Whitestone 57, N. Y.

See January 1957 Issue for Complete Branch Directory

PLATING MAGAZINE announces that its May 1957 issue, besides its usual balanced coverage, will carry an omnibus feature highlighting the origin, growth, development and current status of the AES's Research Program in universities and foundations here and in Canada. This feature will include summaries of all such projects, past or current, prepared by the Research Committee itself.

INDEX TO ADVERTISERS

This index is published as a service to our readers. We regret we cannot assure avoidance of inadvertent errors and omissions despite the many precautions exercised.

All-Brite Chemical Co. 376
Allied Industries Co. 437
Allied Research Products 378 flap
Alsop Engineering Corp. 437
American Agile Corp. 406
American Buff Co. 376, 418, 421, 434, 438
American Platinum Works 369
American Rack Co., Inc. 436
Apothecaries Hall Co. 361
Automatic Rubber Co. 443

M. E. Baker Co. 398
Baker & Adamson Div. 397
Beam-Knodel Co. 418
Belke Mfg. Co. 379
Better Finishes & Coatings, Inc. 368
Bison Corp. 435

Carborundum Co. 430A
Chase Brass & Copper Co., Inc. 432
Cleveland Process Co. 371
Sigmund Cohn Mfg. Co. 376
Commercial Filters Corp. 400
Consolidated Electrodynamics 431

Daniels Plating Barrel Co. 374
Davies Supply & Mfg. Co. 435
Diesel Chemical Co. 439
Diversey, Corp. 356
Dixon & Rippel, Inc. 434
Duggan Masking Devices 443
E. I. DuPont de Nemours & Co. 365

Elkhart Controls Co. 442
Enthone Inc. 347

Federated Metals Div., American Smelting & Refining Co. 362-63
Forcite Corp. 401
Formax Mfg. Co. 443

General Ultrasonics Co. 424
Glo-Quartz Electric Heater 366
Guaranteed Buff Co., Inc. 437
Frederick Gumm Chemical Co. Inc. 2nd Cover

Hanson-Van Winkle-Munning Co. 378A, B, C, D
Harshaw Chemical Co. 350
R. O. Hull & Co. 405

Industrial Filter & Pump Mfg. Co. 413

Joe-D Buff Co. 404

Kocour Co. 414
Joseph B. Kushner 434

Lasalco, Inc. 355
Charles F. L'Hommedieu & Sons 354
Lea Mfg. Co. 410B, Back Cover
Lea-Michigan, Inc. 441
Lea-Ronal Inc. 410A

Macarr, Inc. 425
MacDermid, Inc. 3rd Cover
Meaker Co. 367
Merchants Chemical Co. 407
Metal & Thermit Corp. 377
Michigan Buff Company 436
Michigan Chrome & Chemical Co. 375
Mutual Chemical Division, Allied Chemical & Dye Corp. 430B

National Aluminate Corp. 373
Norton Co., (Abrasives Div.) 417

Oakite Products, Inc. 403
Olin Mathieson Chemical Corp. 411

Packer Machine Co. 422
Phelps Dodge Refining Corp. 429
Pronat Division, Poor & Co. 438

Rapid Electric Company 419
Reynolds Chemical Products 430
Richardson-Allen Corp. 423

Schaffner Mfg. Co. 427-428
E. E. Seeley Co., Inc. 425
Sellers Engineering Co. 359
Sel-Rex Corp., (Precious Metals Div.) 432
Sel-Rex Corp., (Rectifier Div.) 446
Sethco Mfg. Co. 440
Spraying Systems Co. 441
Stanley Chemical Co. 433
Frederic B. Stevens, Inc. 348
Sulphur Products Co., Inc. 438

Tamms Industries, Inc. 443
True Brite Chemical Products Co. 360

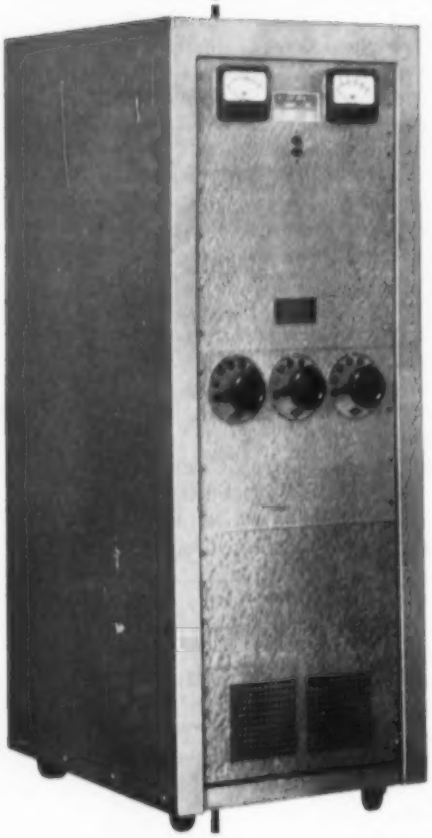
Udylite Corp. 352-53
Unit Process Assemblies, Inc. 436
Univertical Foundry & Machine Co. 439

Wagner Brothers Inc. 357
Wallace & Tiernan 399
Wyandotte Chemicals Corp. 415

Zialite Corporation 434

CUSTOM ENGINEERED RECTIFICATION

priced to compete with ordinary mass-produced equipment!



Sel-Rex GERMANIUM • SELENIUM RECTIFIERS

Thousands of Custom-Engineered Sel-Rex Rectifiers provide millions of amperes to a long list of some of the world's most prominent concerns. This list includes the country's foremost electrical and electronic concerns* — companies best qualified to evaluate rectifier equipment — who repeatedly specify and install Sel-Rex.

Such recognition is not the result of "blue sky thinking" or "gimmick" models or lines... it is the result of delving into cold, hard engineering facts and coming up with the right answers for our customers.

Each Sel-Rex installation represents rectifier equipment *custom-engineered* to fill a specific requirement — no razzle dazzle. Let Sel-Rex custom-design rectification to suit you... it costs no more than ordinary, mass produced equipment — in the long run, it will cost far less.

*Names on request

Sel-Rex®

Rectifier Division

SEL-REX CORPORATION

155 Manchester Place — Newark 4, N. J.

Manufacturers of Exclusive Precious Metals Processes, Metallic Power Rectifiers, Airborne Power Equipment, Liquid Clarification Filters, Metal Finishing Equipment and Supplies.

Offices: Detroit—Chicago—Los Angeles

INDICATE A 481.

S-T-R-E-T-C-H

YOUR COPPER-PLATING EQUIPMENT

- **Brighter, heavier copper deposits with no increase in plating time . . . with present equipment!**
- **Cut buffing time, improve product finish and increase production . . . with present equipment!**
- **Remove chrome contamination that roughens and dulls product finish . . . with present equipment!**

IT'S NEW...
IT'S EFFICIENT...

IT'S

Z/T BRIGHT COPPER!

MacDermid
...right to the Finish!

MacDermid Incorporated, Waterbury 20, Connecticut

We've listed only a few of the many copper plating problems successfully solved by Z/T Bright Copper. Your MacDermid Representative can tell you much more about this new and exciting copper-plating process. He has the know-how to recommend and service the complete plating cycle . . . let him put that know-how to work cutting costs, reducing rejects and improving your product finish.

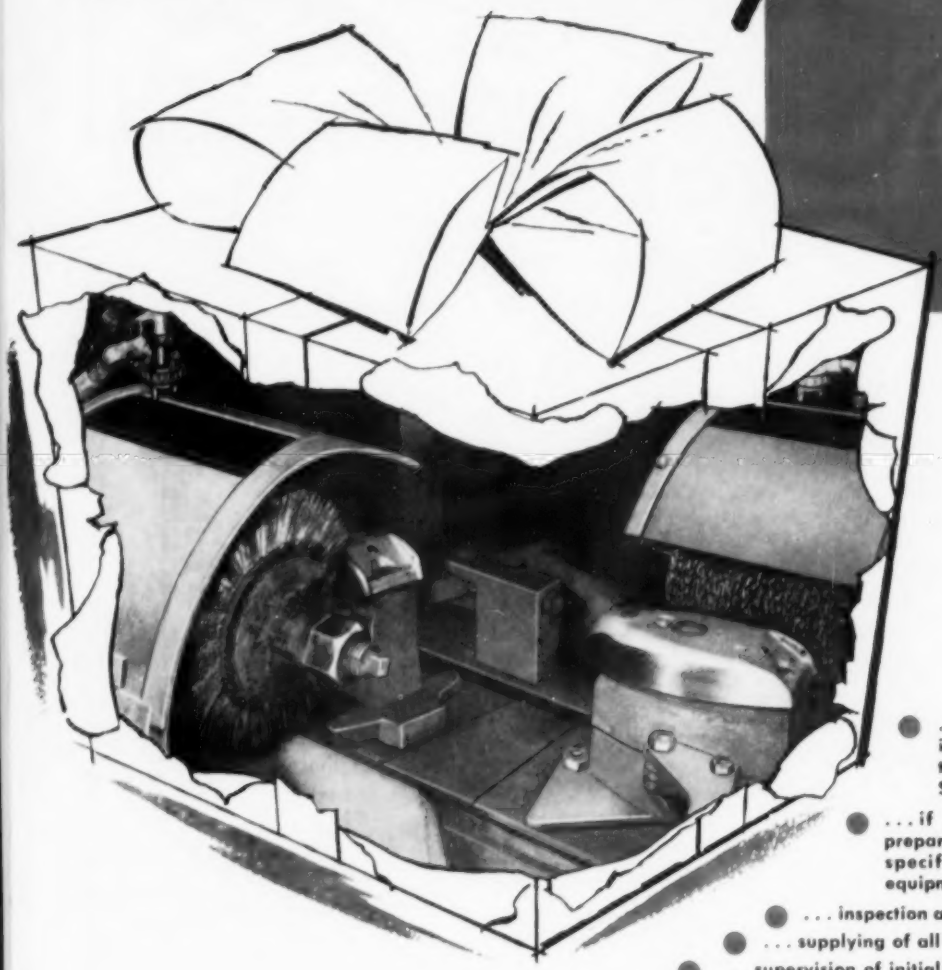
COMPLETE SUPPLIERS TO THE METAL FINISHING INDUSTRY

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE B 401.

Announcing..

LEA PACKAGED PLAN

for continuous automatic LIQUABRADE spray buffing



The basic value in this plan is that you benefit *from all the experience* with both bar and liquid buffing procedures which Lea Finishing Technicians have acquired over many years of service to the metal finishing industry.

The Lea Packaged Spray Buffing Plan consists of the following:

- **. . . study of present intermittent finishing methods with change-over to continuous LEA LIQUABRADE Spray Buffing as the objective.**
- **. . . if change-over seems feasible, preparation of operational layout with specifications for all necessary new equipment.**
- **. . . inspection and final approval of change-over.**
- **. . . supplying of all necessary equipment.**
- **. . . supervision of initial operations.**

Lea Continuous Spray Buffing, utilizing one or more grades of the well known LEA LIQUABRADE, has so well proved itself in a number of plants that every company, particularly those with 'production lines', should consider changing over from bar to liquid. The Lea Technical Service outlined above is available for such a study. The point to keep in mind here is that you are getting the service of Finishing Specialists who not only have been associated with metal polishing and buffing from the early twenties but actually improved upon liquid buffing materials and liquid buffing methods.

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions . . . Manufacturers of Lea Compound and Learok . . . Industry's quality buffing and polishing compounds for over 30 years.

The Hallmark of Quality Products

THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.

Lea-Michigan, Inc., 14066 Stansbury Ave., Detroit 27, Mich.
Lea Mfg. Company of Canada, Ltd., 1226 Birchmount Road Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, England
Lea-Ronal, Inc., Main Office and Laboratory: 139-20 109th Ave., Jamaica 35, N. Y.
Manufacturing Plant: 237 East Aurora St., Waterbury 20, Conn.

INDICATE B 402.